SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXV.—No. 9. [NEW SERIES.] NEW YORK, AUGUST 26, 1876. [$3.20 per Annum. [POSTAGE PREPAID.]

IMPROVED HAND FIRE ENGINE AND HOSE CARRIAGE.

In the accompanying engravings we illustrate an improved hand fire engine and hose carriage combined, which has been especially constructed with a view to meeting the requirements of towns and villages, and isolated factories which do not afford the facilities of steam or the advantages to be derived from a system of waterworks. Hand engines, as usually constructed, require a large gang of men to operate them, making them comparatively useless in localities where 40 to 50 men cannot be assembled at a moment's notice.

The engine herewith represented, we are informed, can be operated by from two to fourteen men, according to the amount of water and the distance the stream has to be thrown. Two men can readily draw it over all common grades. At present the manufacturers are building one size only, the entire equipment weighing only 500 lbs., the hose reel having capacity for 800 feet of 1½ inch hose.

In readiness for fire, the engine is always mounted on the carriage, as shown in Fig. 1, while Fig. 2 shows the engine as detached from the hose carriage, with leading hose run out. Upon an alarm of fire being given, the first man or two at the engine house starts for the scene of action with the machine. Upon arrival the engine is disconnected from the carriage or hose reel by simply turning three clamp fingers, which drop into loops, at A. Two men then lift the engine from the carriage, it weighing alone only 325 lbs., by the handles, B, setting it upon its own ways, C, as shown in Fig. 2, leaving the hose carriage ready to unreel the hose. The hose being always coupled to the engine, no time is lost, as the first sweep of the brakes, after the suction, D, is dropped into the water, starts the stream. The engine is so light that it can be lifted and set over a well, cistern, or reservoir. It really needs no priming, although a priming bucket is provided at E, leading by a stop-cock into the pipe running from the suction to the cylinder. This would prove advantageous should the valves, through non use, become dry. The engine has, of course, two cylinders, the diameter of each being 4 inches, the throw being 6 inches, thus giving a powerful stroke, the brakes moving through a circle of 2 feet 9 inches.

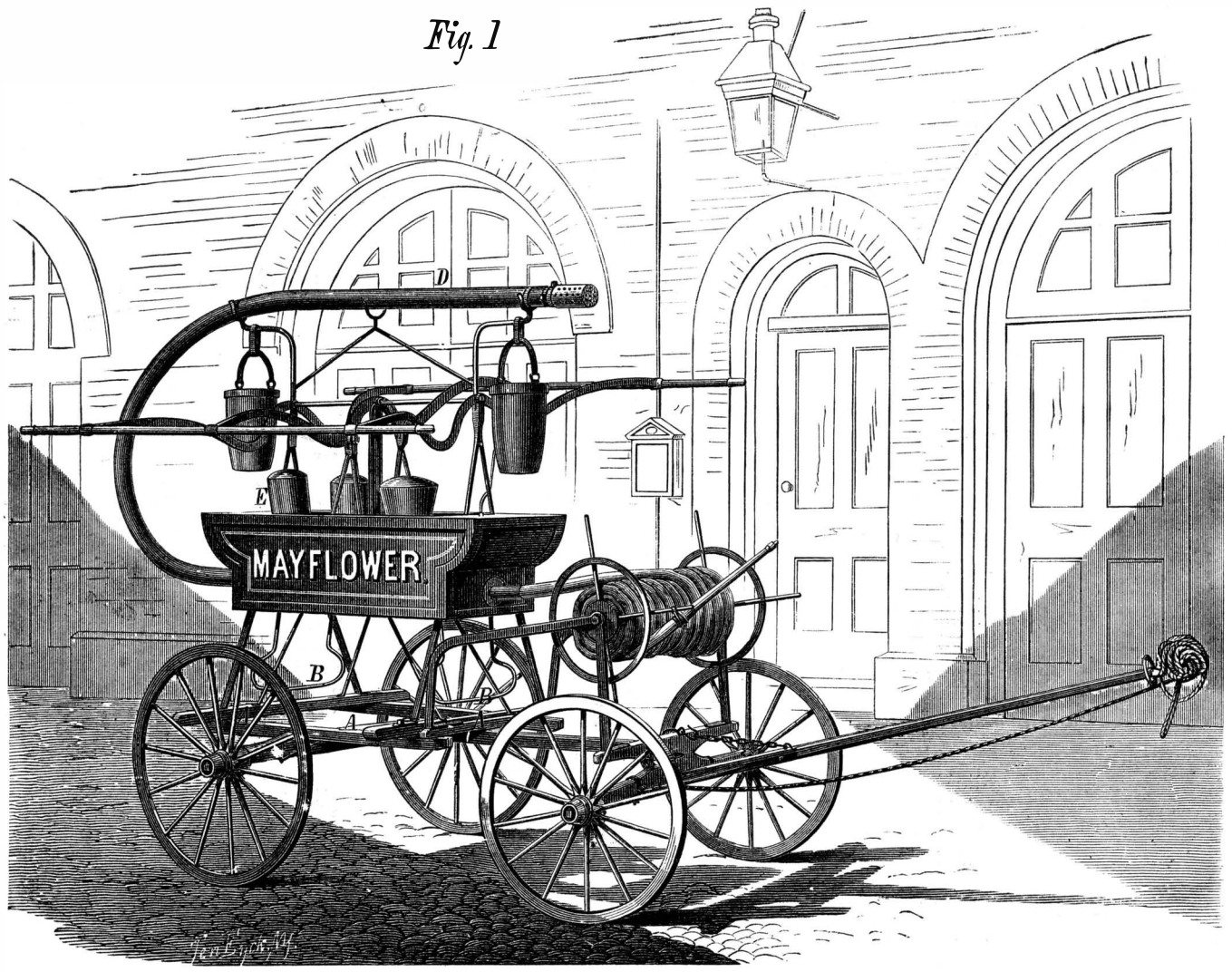
Both air chamber and water chamber are copper, and the valves are composition. The hind wheels are 36 inches high, the forward ones being 32 inches, and the latter swing under the reel, allowing the machine to be turned in its own length. Twelve feet of 2½ inch suction hose are provided, with which are used 1½ inch leading hose with half inch nozzle.

We are informed that with fourteen men the machine has thrown a half inch stream 156 feet horizontally, drawing water perpendicularly 12 feet, and discharging through 100 feet of hose. This range of stream is, as will be seen, sufficient to cover any ordinary factory, warehouse, or dwelling, enabling fires on roofs to be extinguished by the machine stationed on the ground outside.

The makers furnish with the apparatus 12 feet of suction hose, brass strainer, draw rope, spanners for suction and leading hose couplings, two fire buckets, oil can, etc. The complete machine, in readiness for the application of leading hose, is sold for three hundred and fifty dollars at their manufactory.

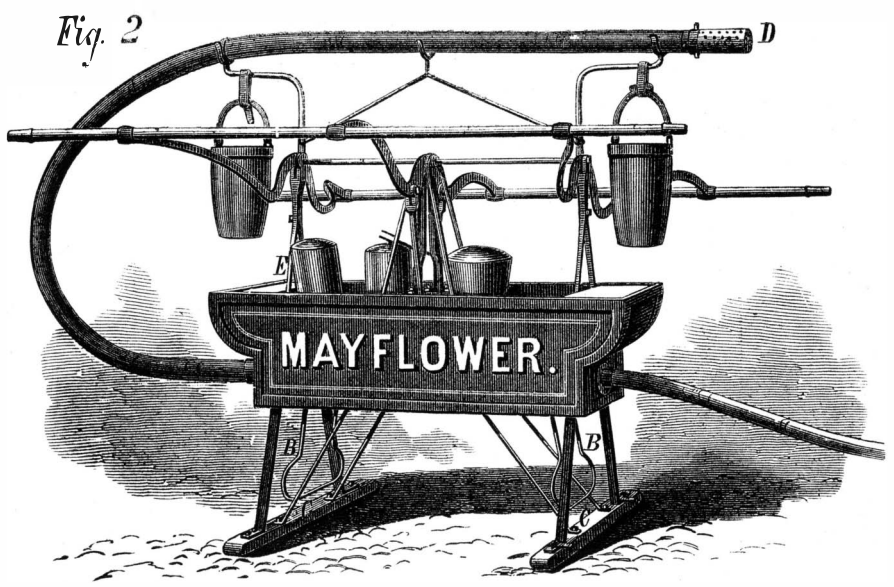
The owner of the patent is A. M. Hall, Malden, Mass., long and well known throughout the country; and the manufacturers are S. C. Forsaith & Co., Manchester, N. H., at whose works the machine can be seen and practically tested at any time. Letters of inquiry or orders should be addressed to either of the above.

Fig. 1



HALL'S HAND FIRE ENGINE AND HOSE CARRIAGE.

Fig. 2



Mineral Wool.—Curious Chemical Change.

The name of mineral wool has been given to a fibrous form of blast furnace slag formed by a jet of steam blown through it while in a liquid state. Professor Wolpert of Kaiserslantern says that it should only be employed with great caution in architecture for filling under floors and wainscoting, etc., for this slag at present always contains sulphide of calcium, which is converted, by the action of the carbonic acid in the air and the water which reaches it when the floors are scrubbed, into carbonate of lime and sulphuretted hydrogen. The latter, as we know, is a gas which is both unpleasant and injurious to health. Before using this slag it should be tested for sulphide of calcium by pouring water and vinegar upon it, when the well known odor of sulphuretted hydrogen, resembling rotten eggs, will be perceived if any sulphuret of lime is present.

Plateau's Soap Bubble Solution.

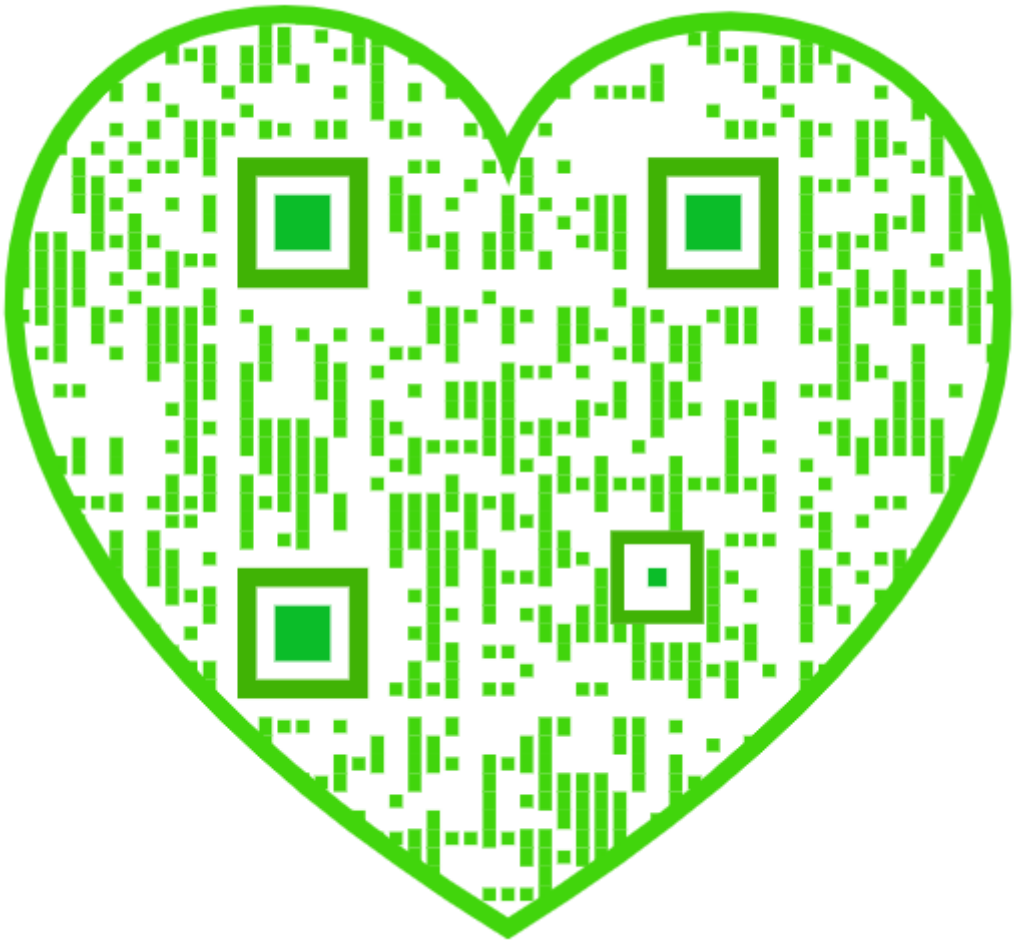
Terquem publishes the following improved process for making a solution suitable for Plateau's experiments with thin films, soap bubbles, etc.: Marseilles soap is shaved up into thin strips and placed in the sun or on a stove until perfectly dry. It is then put into a bottle with exactly 80 per cent alcohol (specific gravity 0·865) until saturated at 60° Fah., when the solution will mark 74° on the centesimal alcoholometer and have the density of 0·880. The solution must be made cold, for when hot the alcohol will dissolve a large quantity of soap and the liquid will become solid on cooling. A mixture of glycerin and water is made so as to stand at 17·1° Baumé, or have a density of 1·35 at 68° Fah., which corresponds to equal parts of each when the glycerin is most concentrated. It is well to heat the bottle containing this mixture in a water bath.

To prepare the final solution, take 100 parts by volume of the diluted glycerin and 25 parts of the alcoholic soap solution; the mixture frequently becomes turbid because the commercial glycerin contains gypsum and lime. It is boiled to expel the alcohol, when the temperature will rise above 212° Fah. It is now allowed to cool, and then poured into a graduated measure and enough water added to make it equal to 100 volumes. It is filtered several times to remove the oleate of lime formed. This filtration is difficult because at first it runs milky through the filter. It is best to filter through a funnel with a tuft of cotton in the neck, as the cotton can be pushed in loosely or tightly to regulate the flow of the liquid. Soap bubbles which are not more than four inches in diameter will keep for an hour if laid on a small tripod under a bell jar.—*Poggendorff's Annalen.*

Fireproof Dress.

Mr. Oestberg, a Swede, has been conducting some sensational experiments in various parts of the Continent with his fireproof suit. This is made in two layers, the inner one of india rubber, the outer of English leather, the head being protected by a helmet resembling that worn by divers. At the girdle is fixed a piece of hose, which serves both for air and water. The air pipe, fed from two blowers, is placed inside the water pipe, and brings the air, after being cooled by the surrounding water, into the inner part of the dress. The air inflates the costume, passing away through the two small openings made for eye pieces. The current of air not only keeps the inclosed body cool, but drives smoke and flame away from the eyes. At the back the water pipe divides, one branch serving as an extinguisher, the other passing into the outer coating of the dress, the stream being distributed over the whole outer surface. With the apparatus on, the experimenter stood in the middle of a pile of burning shavings and logs without taking the least harm. If a continued use of this apparatus shows similar results, it is likely to be a useful invention

© 1876 SCIENTIFIC AMERICAN, INC.



Scientific American.

ESTABLISHED 1846.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included.....$3 20
One copy, six months, postage included..... 1 60

Club Rates.

Ten copies, one year, each $2 70, postage included.....$27 00
Over ten copies, same rate each, postage included..... 2 70

☞ The postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written. In case of changing residence state former address, as well as give the new one. No changes can be made unless the former address is given.

Scientific American Supplement.

A distinct paper from the SCIENTIFIC AMERICAN, but of the same size, and published simultaneously with the regular edition.

TERMS.

One year by mail.....$5 00
SCIENTIFIC AMERICAN and SUPPLEMENT, to one address..... 7 00
Single Copies..... 10

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & Co., 37 Park Row, N. Y.

☞ Subscriptions received and single copies of either paper sold by all the news agents.

VOLUME XXXV., No. 9. [NEW SERIES.] *Thirty-first Year.*

NEW YORK, SATURDAY, AUGUST 26, 1876.

Contents.

(Illustrated articles are marked with an asterisk.)

Amalgamating apparatus*..... 131
Angle circle, glass..... 133
Aniline photo process..... 133
Animals, the resources of..... 131
Answers to correspondents... ... 139
Aquarium, a marine*..... 135
Bleaching by alum salts..... 137
Bleaching sponge..... 129
Blue color, new..... 134
Boats, paddlewheels for (6)..... 139
Business and personal..... 139
Carbon disulphide, purifying..... 131
Carpet, what is an ingrain..... 133
Chemical dangers by light..... 132
Cider, boiling (23)..... 139
Cider, preserving (13)..... 139
Colors and weak eyes (4)..... 139
Concrete walls, etc., (31)..... 140
Damp-proof buildings..... 140
Dental gardening..... 134
Echoes in school rooms (8)..... 133
Egg holder*..... 131
Engraving process, new..... 134
Fire arms, breech-loading*..... 130
Fire engine, etc., hand*..... 127
Fireproof dress..... 127
Flower basket, Japanese..... 134
Fruit, preserving (14)..... 139
Gear wheels* (12)..... 133
Greenstones, New Hampshire..... 136
Guano, artificial..... 128
Guano, bat..... 136
Hops as a photo preservative..... 134
Huxley's arrival, Professor..... 129
Hydrophobia, preventive of..... 129
Jetties, the..... 131
Lampwick trimmer*..... 131
Lead, handling (29)..... 140
Lead on an engine (19)..... 139
Light and ferric chloride..... 133
Light and silver..... 133
Light, the impact of 132
Light, what it is..... 132
Locomotives, incendiary..... 129
Magnetism, attraction of (2)..... 139
Man, physical, in America..... 128
Marble, imitation..... 130
Marble, stains on (1)..... 139
Microscope screws (8)..... 139
Mortar, bright red (5)..... 139
Nail exhibit, Swedish*..... 134
Naval items..... 137
New books and publications..... 137
North star on the meridian * (10). 139
Oil pipe 300 miles long..... 130
Organ pipe metal..... 130
Patents, American and foreign.. 137
Patents for seeds and planters... 134
Patents, official list of..... 140
Pencil writing, copying (27)..... 139
Pendulum, compensating..... 133
Photographic action, etc..... 132
Photographs, magic..... 133
Platinum and vanadium..... 133
Poisoning by Virginia creeper... 134
Polishing in the lathe (8)..... 139
Potassium dichromate..... 133
Pressure by blowing fans..... 134
Prize for bleaching agent..... 130
Purple cyanide dyestuff, a..... 186
Railway, the first Chinese..... 132
Refrigerators, lining (11)..... 139
Reindeer made of nails *..... 341
Rocky mountains, age of the, etc. 129
Rubber, dissolving (15)..... 139
Saw, hot steel rail*..... 134
Sheep dogs, training..... 137
Silver chloride and light..... 132
Soap bubble solution..... 127
Speech, the development of..... 132
Springs, coiled (12)..... 139
Straighten a shaft, how to..... 132
Summer science..... 128
Sun's time, the (2)..... 139
Tea stains on oak (25)..... 139
Telegraphy, musical*..... 136
Telescope glasses (7)..... 139
Tobacco, coloring (26)..... 139
Tunnel, the San Fernando..... 134
Vapor baths (22)..... 139
Vinegar, clarifying (17)..... 139
Watches, cleaning (28)..... 139
Water for drinking (16, 21)..... 139
Water, lime (22)..... 139
Water, mineral (22)..... 139
Wells in houses (9)..... 139
Wool, mineral, curious change.... 127

THE SCIENTIFIC AMERICAN SUPPLEMENT.

Vol. II., No. 35.

For the Week ending August 26, 1876.

TABLE OF CONTENTS.

1. THE INTERNATIONAL EXHIBITION OF 1876, with 37 figures.—Exhibits of the Hartford Boiler Inspection Company, 10 figures.—Valuable Information about Boilers.—Needle Machinery at the Exhibition, 2 figures.—Williamson's Hoist Machinery, 1 figure.—Bliss and Williams' Exhibit of Power Presses, 6 engravings.—Locomotives at the Exhibition, 18 figures, with Table of all Principal Dimensions of all Locomotives Exhibited.

II. ENGINEERING AND MECHANICS. With 6 engravings.—The Railway Tunnel under English Channel, 1 engraving of the Shaft.—Railway Brakes.—Taking Up Water without Stopping.—Grattan's Pneumatic Telegraph, 2 engravings.—Fireproof Towns.—Pumping Exhaust Steam Back to Boiler.—Ice Skating in Summer.—The Glaciarium, London.—Ice-Making Machine of the London Ice-Skating Rink, page engraving.—Loan Collection of Scientific Instruments.

III. TECHNOLOGY, ETC.—Industrial Uses of Aluminium.—Process for Photo-Chromic Prints.—25 New Dyeing Recipes—Protection of Steam Reds.

IV. ELECTRICITY, LIGHT, HEAT, ETC. — Lightning Conductors.—Double Telemeter, 3 engravings.—Clamond's Thermo-Electric Battery.

V. NATURAL HISTORY.—The Ocean's Bottom, 4 engravings.—Globigerina, Orbulina, Rhabdosphere.—Functions of Cerebrum.—The World's Alphabets, 5 engravings.—How Plants Feed.—Guarana.—Roscoelite.

VI. MISCELLANEOUS.—Society of Antiquaries.—Shooting Stars, by Professor YOUNG.—The Satellite of Venus.

The Scientific American Supplement

is a distinctive publication issued weekly; every number contains 16 octavo pages, with handsome cover, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies, 10 cents. Sold by all news dealers throughout the country.

COMBINED RATES.—The SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT will be sent together for one year, postage free to subscribers, on receipt of $7.00.

TO SCIENTIFIC AMERICAN SUBSCRIBERS WHO WISH TO TAKE THE SUPPLEMENT.—A subscriber to the SCIENTIFIC AMERICAN may change at any time to the SUPPLEMENT, or may have both papers sent to him, by remitting to us the difference between the amount already paid for the SCIENTIFIC AMERICAN and the SUPPLEMENT prices above mentioned.
Remit by postal order. Address

MUNN & CO., PUBLISHERS,
37 Park Row, New York.

All the numbers of the SUPPLEMENT from its commencement, January 1, 1876, can be supplied; subscriptions date with No. 1 unless otherwise ordered.

☞ Single copies of any desired number of the SUPPLEMENT sent to any address on receipt of 10 cents.

PHYSICAL MAN IN AMERICA.

From time to time every great mercantile or manufacturing firm slackens the work of making and selling to review its position and possessions: as the phrase runs, to take an account of stock. Just now the American people are similarly engaged in taking stock.

We have had a hundred years of general prosperity, a hundred years of rapid growth in numbers, wealth, and power: and very properly we celebrate our Centennial year in reviewing the results of the years that have gone, in trying to learn our relative standing among the nations. Not only in the great sample show of our natural and industrial resources at Philadelphia, but everywhere throughout the land, are manifestations of the same laudable desire to discover just what we are worth as a nation, what the past has done for us, and what the prospect is for the future.

There is danger however that, with our absorbing interest in the things we have invented, discovered, and made, in our mental and industrial achievements, we may forget the more important item of national stability, what we are: in other words, the character and conditions of our physical manhood. How do we compare bodily with the citizens of more homogenious nations? How big are we, on the average: what is our condition as to health and disease: what is our working force, and how long does it hold out?

Questions like these are especially pertinent at this time; for what our country shall be during the coming centuries depends far more upon the physical character of the people than upon the things they have or the machines they use.

It is fortunate that the material for such studies of physical man in America are ready at hand, thanks to the excellent use made by the Provost Marshal General's bureau of the records of examinations for military service during the late war, an elaborate digest of which has just been completed by Dr. J. H. Baxter, late chief medical officer of that bureau, and published by the United States Government. The records cover the physical examinations of more than half a million men, furnishing an amount of data largely exceeding in extent any of a similar nature ever before collected and published. And, as Dr. Baxter justly observes, the value of this enormous mass of statistical matter is hightened by the circumstances that it does not relate to soldiers already in the field, picked men in no wise representing the masses, but to the people: the men engaged in every occupation, professional men, and men of letters, traders and business men of every grade, laborers skilled and unskilled, the rich and the poor, the robust and the crippled: in short, to all the citizens of the country, whether of native or foreign birth.

During the first two years of the war, the armies were recruited by volunteer enlistments, under the control of the State authorities. This method proving inadequate, Congress passed an act, in the spring of 1863, creating a bureau of the war department to be known as the Provost Marshal General's, and to have charge of the recruitment of the armies, by enlistment or by draft as might be necessary. As a preliminary to the latter method, an enrolment of all persons liable to perform military service had to be made; and in order that none but able-bodied men should be put in the field, a thorough and systematic medical examination of all drafted men and volunteers was necessary. Four drafts were made, the whole furnishing records of the examination of 605,045 men, of whom 155,730 were exempted, or a ratio of 257·39 per thousand. During the same period there were examined 225,639 volunteers and 79,968 substitutes. Of the former 50,008, or a ratio of 221·63 per thousand, and of the latter 21,125, or a ratio of 264·17 per thousand, were rejected.

Of these and other records, covering the examination of over a million men, nearly half were found more or less incomplete and were thrown out; but as those which could be used seemed to be fair representatives of all, the omissions abridged the work rather than detracted from its value. The records made use of showed for each of the subjects of examination his age, nativity, residence, occupation, hight, complexion, color of eyes and hair, girth of chest at inspiration and at expiration, social condition (married or single), color, general physical constitution and condition, distinguishing natural or accidental mark if any, in case of acceptance, and specification of disease or disability in case of rejection. The scope of the final report is in the main the comparison of each of these elementary conditions with others, and a consideration of their relation to disease. The tables in which nativity is an element of the comparison show the physical condition of the foreign-born citizens of various nativities in relation to each other, and to native Americans, both white and colored.

The first fifteen tables, the anthropological series, treat of physical qualities without relation to disease; the remaining seven are pathological, treating of disease and its relation to the physical qualities of man, to occupation, and to locality. To facilitate the interpretation of the latter a series of charts have been prepared, presenting to the eye the more interesting results deduced from the tables: also a number of maps showing by gradations of color the prevalence of disqualifying diseases together and singly, by congressional districts. In the letter press, the reviews of the tables call attention to what is most interesting and significant of the lessons they teach, and furnish an amount of information with regard to American manhood, physically considered, the relative healthfulness of different parts of the Northern States, the relation of health to employment, and so on, that is truly wonderful.

Another exceedingly valuable portion of the work is the three or four hundred pages of Part III, containing reports of examining surgeons. In these is given, with other interesting matter, a connected and generally graphic account of each congressional district by a resident physician, covering its physical description, its prevalent diseases and their local causes, the general character of the inhabitants, their modes of life and occupations, the fitness of the different classes and nationalities for military service, and so on. From these, in connection with the tables and colored charts, it is our purpose to draw much curious and valuable information for the entertainment of our readers: to sum up, so to speak, our physical assets and liabilities as a nation.

SUMMER SCIENCE.

We have received a periodical bearing the name "Appalachia," a rather mystifying title until one peruses the pages sufficiently to learn that the magazine is intended to be the report of results accomplished, plans proposed, and information gathered by the Appalachian Mountain Club, the object of which association is the thorough geographical, geological, topographical, zoölogical, and botanical study of the mountains of New England and adjacent regions. The required knowledge is to be obtained by systematic exploration conducted by the members individually; and one cardinal aim and object is the publication at some future time of "a detailed and accurate map of the White Mountains, upon a large scale and in the very best style of workmanship."

It seems to us that those who have organized this club deserve credit for a very sensible idea, and one that merits to be widely imitated. Camp life in the summer, as witness the throngs which yearly visit the Adirondack region in this State, is extremely fascinating, and generally a grand restorer of impaired health. Beside it offers to the hunter and fisherman the best opportunities for sport. Now a club with the objects above stated combines all the benefits of outdoor life, besides placing before its members a definite and useful aim, so that each individual mingles with his holiday relaxation work which, from its very novelty and variety, ceases to be labor, and yet is of sufficient importance to stimulate the best endeavors. We cannot imagine anything more enticing to the scientific student than a summer spent with such a club as the Appalachian. If his tastes incline to natural history, he has only to read Professor Sterry Hunt's admirable letter of instruction to know, as Faraday expressed it, just "what to look for." There are floral materials to collect, limits of altitude of trees, plants, and animals to be noted, nature and distribution of rocks to be observed, rare and remarkable vegetable productions to search for, and so on through a long category. Does he desire a summer of practical surveying, Professor Hitchcock tells just what is to be done and how to go about it, gives a list of points to be determined, and even describes the needful instruments. The artist is offered an enchanting sketching tour, and Professor Fay explains how the knight of the brush and pencil can make himself scientifically useful. Professor Pourtales tells where original explorations are needed, and how they are to be conducted: lastly, Professor W. G. Nowell, for the benefit of those who do not care to be pioneers, suggests where paths may be made, record bottles placed, points of view to be cleared, and other improvements accomplished, which will facilitate the general work. It is original investigation conducted under the pleasantest conditions, and certainly well calculated to give those who undertake it a zest for discovery which may stimulate them to higher aims.

Beside, the task projected has a wider utility than is involved in its immediate result. There is a lamentable ignorance all over this country regarding our own territory, an ignorance which across the Atlantic becomes surprisingly dense, even among people otherwise highly educated. Our English contemporaries constantly quote American localities incorrectly; and to the minds of continental writers, our cities, counties, and States seem inextricably confused. In geography, as in all sciences, true knowledge has its foundation in details; and where those are clearly and accurately determined, we may look for generalizations based thereon to be equally correct. In the United States, the youth of the nation, and the fact that there are still portions of our immense territory wholly unexplored, are the obvious reasons why general information has been compiled without the substantial basis we have indicated; and many years will elapse before we shall have that intimate knowledge of our land which the marvelously minute topographical maps of Sweden, exhibited at the Centennial Exposition, prove that the Swedes have of theirs. Still we know of no better means of securing such useful information than by the labors of scientific students, associated as in the present club, which we trust may be but the precursor of others formed in other parts of the country.

ARTIFICIAL GUANO.

The enormous value of the guano deposits of the Chincho and Lobos Islands naturally gave rise to an early and eager search for similar stores of agricultural wealth in other localities. And seeing that sea fowl were not less numerous and voracious on uninhabited islands the world over, there seemed to be no reason why the search might not be successful. But it soon became clear that climate had much to do in the matter. Only in rainless regions where the slowly accumulating layers of excrement, fish bones, dead fowls, and so on could remain undisturbed and undissolved was it possible for true guano to accumulate. The search for it, however, was not without good results On many other islands, especially in the equatorial regions of the Pacific, there were found extensive beds of rock, which differed from the usual coral rock in that it contained a large percentage of phosphate of lime, the mineral base of Peruvian guano At first it was supposed that, by some mysterious chemistry

© 1876 SCIENTIFIC AMERICAN, INC.

of nature, the coral carbonate had been changed to phosphate of lime; but subsequent researches proved the phosphatic rocks to have had their origin in the air, not under water. They were simply the remains of what in a more arid climate would have been regular guano beds, their organic matter having been dissolved and washed away by rain.

To convert these phosphatic deposits into commercial fertilizers, it was simply necessary to restore the organic elements which had originally accompanied them, for which purpose nothing seemed so appropriate as the refuse of fish oil factories. All along our northern coast, enormous quantities of menhaden were annually taken for their oil; and the compressed fiber and bone remaining after the extraction of the oil afforded a vast quantity of nitrogenous matter, similar to that produced in the digestive organs of fish-eating sea fowl. The company which had undertaken to utilize the phosphatic deposits of the Pacific islands set up their works at Wood's Hole, Mass., at the heart of the menhaden fishery, and there the fish of the Atlantic were made to supply the wasted elements originally drawn from the fish of the Pacific.

A model of these works is shown in the Government Building, at Philadelphia; and in the company's special pavilion are models of their other works, with a full exhibit of the processes employed, the materials used, and the products obtained.

The exhaustion of the richer beds of Pacific phosphates (and only the richer would pay for transportation) led to a search for like deposits nearer home, resulting in the discovery of the extensive deposits of Great Swan Island, in the Caribbean Sea, about a hundred miles from the coast of Honduras. But this source was soon eclipsed in value and interest by the rich phosphatic deposits along the South Carolina coast. Though known for nearly a century, the fertilizing character of these beds was not detected until 1867, when Dr. Ravenal discovered that their characteristic nodules of supposed marl rock were really composed almost entirely of phosphate of lime, and immediately made arrangements for their collection and conversion into commercial fertilizers, in the place of the Swan Island phosphates he had hitherto been using.

Previously, the interest attaching to these beds had been chiefly scientific, arising from the strange revelations of ancient life made by their fossil remains—revelations of a time long anterior to the historical period, when our familiar domestic animals, once supposed to have originated with man in Asia, horses, sheep, bulls, and hogs—were living here with animals peculiarly American, as certain deer, musk rats, beavers, hares, opossums, and the South American tapir.

The phosphatic nodules in question are found along the water courses of the Sea Island region between Charleston and Savannah, the largest development occurring on Chisolin's Island, about midway between these two cities, at the junction of the rivers Coosaw and Bull. The island, about six miles long by two miles wide, is underlaid with strata of nodules varying in thickness from one to three feet. At the diggings of the Pacific Guano Company, to whom the island belongs, the phosphatic stratum lies from two to five feet below the surface, and is about three feet thick. Nodules are also found in quantities in the beds of adjacent creeks. Properly treated, they yield an average of phosphoric acid equal to sixty per cent of phosphate of lime. The Swan Island's phosphates are less rich, except in the deeper deposits, some of which yield as high as eighty per cent of lime phosphate.

In the conversion of these phosphatic rocks into soluble fertilizers, they are first dried and pulverized; then, after being reinforced by the richly nitrogenous fish fiber, the whole is digested with sulphuric acid, producing an artificial guano analogous in nature and composition to the purest Peruvian guano, and equally efficient for the nutrition of growing crops.

By this industry, one of the most abundant and uneatable of our coast fishes, the menhaden, is made one of the most valuable. During the past year, upwards of twenty-six hundred men, with three hundred and forty-three vessels, nine of them steamers, were employed in the menhaden fishery. The capital involved was nearly three million dollars, and over five hundred and sixty million fish were taken. Besides the 2,681,487 gallons of oil obtained for commercial purposes, these fish yielded over fifty thousand tuns of compressed fiber and bone, carrying more than seven and a half million pounds of ammonia in the best possible organic form, the equivalent of 26,000 tuns of Chincha Island guano, and over 1,000,000 lbs. of phosphate of lime, readily convertible into agricultural products.

THE STRUCTURE AND AGE OF THE ROCKY MOUNTAINS.

From the Missouri river westward, the whole country gradually rises, at an average grade of barely ten feet to the mile, until about the meridian of 105½° W. is reached, and then the Rocky Mountains rise abruptly from the plain. Thence to somewhat beyond 108° W. the country is traversed by numerous mountain ranges, separable into two series. The first series comprises two complex axes of elevation, the front or eastern and the Sangre de Christo, whose trend is from N. 10° W. to N. 30° W. The second series is made up of the San Juan, Los Piños, La Plata, and San Miguel ranges, which have a trend of N. 30° W. to N. 45° W. Each series shows a parallelism in its ranges, and the whole system terminates *en échelon* southward, most of the axes ending in Colorado.

The eastern range, which consists of several closely packed parallel axes, and rises sharply from the plain, is composed of metamorphic rocks, badly fissured by dykes of lava, and not unfrequently capped by lava overflows. The schists are much torn and faulted, and side throws of mineral veins are not uncommon. Along the median line of the axis, exposed here and there by deep cuts, a compact granite, more or less syenitic, appears to prevail. The sedimentary rocks occur as "hog backs" along the eastern base, and curve round the southern terminations of the several axes.

The second range, provisionally named the Sangre de Christo by Dr. Stevenson—to whom (Report of Engineer Department, Wheeler Expedition, 1875) we are indebted for these particulars—is in the main almost parallel with the eastern range, but is much more complex in its structure. Its width is about twenty-five miles in the northern part, diminishing to twelve miles at Sangre de Christo Pass. With its extension, the Spanish range, it is, in Dr. Stephenson's opinion, but the southern portion of a magnificent group which once covered the whole region from East River to South Park. It remains for future explorations to solve the many problems which its complicated structure involves. In the main portion no rocks have been found of later date than the carboniferous.

The third great axis is the San Juan, for the most part buried under a great mass of volcanic rocks, which almost conceal those of sedimentary origin. Wherever exposed, a marked unconformability is seen between the carboniferous and the overlying rocks. The older formations are inclined at a very high angle, while the cretaceous and (doubtfully) the triassic, which are conformable to each other, have a very small dip.

The next great axis toward the west is the one termed by Dr. Newberry the Los Piños, in part the divide between the Rio de los Piños and the Rio Piedra. The only rocks involved are the carboniferous and (probably) the Silurian. On each side of the range, which is not more than five or six miles wide, the cretaceous rocks are seen forming mesas and dipping only two or three degrees.

The next axis, the La Plata (Newberry) forms in part the divide between the Rio de la Plata and Rio de los Animas. The course of the uplift is almost northwest, and the dip is very gentle where the strata have not been locally disturbed by lava dykes. The only rocks involved are the palæozoic, against which the triassic and the cretaceous abut at a slight angle.

The San Miguel axis is still farther westward, and, like the La Plata, involves only palæozoic rocks, those of mesozoic times forming mesas around it. Beyond, to the westward, extends a cretaceous plateau separating the Rocky Mountains from the Great Basin.

From his admittedly partial explorations, Dr. Stevenson finds it sufficiently evident that the Rocky Mountains are not the result of a single grand upheaval, and that the several axes are not wholly synchronous in origin. The general diminution of disturbance westward, as shown by the diminishing steepness of dip, together with the general trend of the several axes, shows that the disturbing force was propagated from the east or east of northeast.

The relations of the strata of the several periods make it easy to determine the era and the comparative energy of the successive upheavals. The first was at the close of the carboniferous period. The Silurian and the carboniferous are everywhere conformable, showing that, during the time of their deposition, there must have been either comparative quiet or continued subsidence. The line of continuous action thereafter seems to have been that now occupied by the eastern range. In this region there was a subsidence during the trias, which but slightly, if at all, affected the interior

The second epoch of elevation began toward the close of the triassic, and was marked by an exceedingly energetic action along the eastern line, accompanied by a grand eruption of igneous rocks. The conformability of the trias and the cretaceous in the San Juan area shows that the energy of the convulsions diminished westward and southwestward from the main line of disturbance. After the second upheaval there was an extensive subsidence, the record of which appears in the prevalence of cretaceous deposits over the whole Rocky Mountain area.

The third epoch of elevation followed hard upon the cretaceous period. The action is generally violent, in some parts terrific, resulting in a perfect maze of cross faulting. Everywhere north and east of the Rio Grande, the volcanic disturbance was excessive, a vast area being buried under a sheet of lava from two thousand to three thousand feet thick; and enormous dykes, stretching from the Sangre de Christo southeastward far out into the plain, remain to attest the widespread effects of the disturbance.

During the tertiary age, another but much slighter elevation took place, giving the rocks of that age a dip of five degrees. Of the four upheavals, the first and third were much the most general in their effects. The first was synchronous with that during which the Appalachian chain was completed.

INCENDIARY LOCOMOTIVES.

Conflagrations produced by sparks and fire from locomotives are by no means of unusual occurrence. It only necessary to observe after nightfall the fiery shower, with which every engine not supplied with proper spark arresting devices liberally besprinkles the track and its immediate vicinity, to discover why wooden buildings, oil in tanks, and hay ricks are constantly being destroyed, and in autumn to feel some wonderment that the adjacent fields of ripe grain or sun-dried prairie grass are not more frequently kindled. It cannot be doubted that many a fire is ignited in cities, as well as in country villages through which an express train rushes at fifty miles per hour, the unknown cause of which is the locomotive, scores of miles away before the fire breaks forth.

We are exceptionally patient people, however, and individually at least prefer suffering the loss of a burnt barn than to become involved in legal proceedings *versus* a huge and wealthy corporation. But on the other hand, immunity on the part of the railroads in this respect begets carelessness likewise on their part, notably in the provision of the devices, easily obtainable, which will prevent their locomotives being perambulating incendiaries. The consequence is an increase of the evil; so that not only has a loser a private end to gain in seeking prompt redress from the railroad company, but he has a public duty to perform in enforcing his right. The railroad, it should be remembered, enjoys its privileges by the sufferance of the people, and it is conditioned not only to serve the public in certain ways but to exercise diligence not to work injury to the public. It is therefore responsible for its negligence; and generally it is incumbent on the railroad to show conclusively that the person injured actively contributed by his individual neglect to effect the result, if it would save itself from being cast in damages. The tendency on the part of courts and juries is to hold all corporations with great strictness to their duties; and in this rigid enforcement of the law is found the safeguard of the people against the abnormal exactions which great controlling monopolies would otherwise too often be in position to demand.

The manner in which the law regards fires produced by locomotives is cogently stated in a decision recently reached by our highest tribunal, the Supreme Court of the United States. The case was that of R. M. Richardson *vs.* the Grand Trunk Railway Company of Canada. Certain buildings for freight purposes and for his individual benefit had, by Richardson, been erected, with the company's permission, on land owned by the railroad. These were destroyed by fire from a locomotive, and the action was brought to recover. In its opinion, the court said that the issue to be determined was whether the defendants had been guilty of negligence—that is, whether they had failed to exercise that caution and diligence which the circumstances demanded, and which prudent men ordinarily exercise. Hence the standard by which their conduct was to be measured was not the conduct of other railroad companies in the vicinity, certainly not their usual conduct. Besides, the degree of care which the law requires, in order to guard against injury to others, varies greatly according to the circumstances of the case. When the fire which caused the destruction to the plaintiffs' buildings occurred, it was a dry time, and there was a high wind. At such a time greater vigilance was demanded than might ordinarily be required. The usual practice of other companies in that section of the country sheds no light upon the duty of the defendants when running locomotives over long wooden bridges in near proximity to frame buildings, where danger is more than commonly imminent. Evidence was held admissible as tending to prove the possibility and a consequent probability that some locomotive caused the fire, and as tending to show a negligent habit of the officers and agents of the railroad company. It was further held that it made no difference that a large part of the property destroyed was wrongfully on the railway, the court sustaining the ruling in a case cited that the company in such a case was bound to exercise ordinary care to avoid injury, even to a trespasser.

The Arrival of Professor Huxley.

Professor Huxley, the celebrated English scientist, has arrived in this country. He is at present traveling privately, and will devote the greater part of his brief visit to the Centennial Exposition. It was not his intention to deliver any lectures here, but he has lately reconsidered his determination, and has consented to give three discourses during the latter part of September, in this city. The topics are not yet announced, but this is immaterial, as there is sufficient curiosity to see an investigator, whose name and works are as familiar to us as to his own countrymen, to fill the largest hall New York possesses. Meanwhile, until our people shall have the promised opportunity of collectively greeting the eminent gentleman, we take the liveliest pleasure in extending to him, on the part of the scientific workers, the inventors, and the mechanics of this country, a most cordial and hearty welcome.

Preventive of Hydrophobia.

In a letter published in a recent number of Professor Gubler's *Journal de Thérapeutique*, another addition is made to the already formidable list of prophylactics against hydrophobia. Dr. Grzymala, of Krivoe Ozeroe, Podolie, reports that during the last ten years he has treated at least 100 cases—in human subjects as well as beasts—of bites by hydrophobic animals with the powdered leaves of *xanthium spinosum*, with success in every case except one, although cases of bites inflicted at the same time, but treated in other ways, had terminated in death. The drug is described as possessing sudorific, sialagogue, and slightly diuretic properties, but less pronounced than those of jaborandi. The dose for an adult is 9 grains of dry powder of the leaves, repeated three times a day and continued during three weeks; to children under 12 years, half the quantity is given.

TO BLEACH SPONGE.—Soak it well in dilute muriatic acid for twelve hours. Wash well with water, to remove the lime, then immerse it in a solution of hyposulphate of soda, to which dilute muriatic acid has been added a moment before. After it is bleached sufficiently remove it, wash again, and dry it. It may thus be bleached almost snow white.

© 1876 SCIENTIFIC AMERICAN, INC.

BREECH-LOADING FIREARMS.

It has been stated by Bayard Taylor and other travelers that a revolving pistol, with one barrel and a cylinder to be loaded in several chambers, is to be found in a collection of ancient armor, in Warwick Castle, England, and that another, of similar design, is to be found among the relics exhibited in the Tower of London. But these remarkable curiosities can scarcely be considered to depreciate the value of the modern breech-loading rifle, the details of which have probably been the subject of as many patents as those of any other appliance. We publish herewith the first of a series of engravings of the many improvements effected during the last few years, which we extract from Mr. E. H. Knight's "American Mechanical Dictionary."*

The Martini gun, A, is the invention of a Swiss. The breech block is pivoted at its upper rear portion, being moved up and down by a lever at the rear of the trigger guard. The firing is by a spiral spring, which actuates a firing pin. The cartridge shell extractor works on a pivot below and behind, the barrel being operated by the descent of the front end of the breech block upon one arm of the bell crank lever.

The Chassepot gun, B, is the French arm, and is named after its inventor. It is what we term a bolt gun, an opening on the right hand of the chamber admitting the insertion of the cartridge. The forward thrust of a knob drives the cartridge into the breech, and a partial rotation of the knob locks the breech piece. The firing is by a needle.

The Prussian needle gun, C, is also a bolt gun, having an inner bolt which forms the firing pin, a sleeve around it, and an outer cylinder, the parts are shown with the needle in its fired position. In preparing to reload, the rear knob is withdrawn, and the axial bolt retained by a catch which engages a projection, withdrawing the needle. The chamber is then unlocked by the knob and slid back, the cartridge inserted and driven into the breech by the chamber, which is locked by a partial rotation. The firing is done by releasing the needle bolt.

In Maynard's rifle, D, the barrel is pivoted to the front end of the stock, and its rear end tips upwardly, exposing the chamber for the cartridge, when the barrel is tipped down against a solid breech piece and locked. The Maynard primer consists of pellets of fulminate placed at regular intervals between narrow strips of paper. This is coiled in a chamber in the lock plate, and is fed forward by a wheel operated by a hammer, so as to bring a pellet on top of the nipple at each discharge.

The Merrill gun, E, was constructed for a paper cartridge. The breech was closed by a sliding plug locked in place by a combination of levers. The charge was exploded by a copper cap, placed upon the nipple in the ordinary manner.

The Spencer rifle, F, is both a magazine and a single breech-loader, seven cartridges being placed in a magazine in the butt, and being thrown forward to the chamber as required. The breech block is a sector pivoted beneath the level of the barrel, and retreating backward and downward to expose the rear of the bore for the insertion of the cartridge. The trigger guard forms the lever for moving the breech block.

The Laidley gun, G, has a breech block pivoted beneath the barrel and rotating backward and downward to open the chamber. When in position for firing, it is fastened by a locking brace which is operated by a spring and vibrates on the same axis as the hammer. The breech block is unlocked by a cam and thrown back by a pawl attached to the locking brace and actuated by the hammer.

The Westley-Richards gun, H, is an English arm, having a pivoted breech block whose front end is depressed by the action of a lever pivoted to the stock beneath the rear of the barrel.

The Snider gun, I, built at Enfield, England, is similar to our Springfield converted rifle, which we shall describe in a future issue. The breech block is hinged behind and above the barrel, the block throwing upward and forward, exposing a chamber behind. Into this the cartridge is dropped, pushed into the bore, the block brought down and locked by a latch in the rear. The firing pin passes obliquely through the block, and is struck by the ordinary hammer.

The Berdan form of this type is shown at J, and has a breech block in two sections hinged together.

K is the Peabody gun, which has a falling breech block, hinged at the rear and depressed by the guard lever, whose short arm engages in a recess of the block and controls its movements. When the block is down, the cartridge is slipped into the bore, and the piece is fired by the fall of the hammer upon a firing pin sliding in a groove in the side of the block. In opening to reload, the block drops upon an elbow lever and withdraws the spent cartridge shell.

The Roberts gun, L, has a breech block pivoted at the rear, operated by a lever which extends backwardly over the small of the stock; the forward end of the breech block being depressed, the center of its motion and its abutment in firing being a concave solid brass centering on the exact prolongation of the axis of the barrel. The breech parts are four in number, articulated without pins or screws. The firing pin passes centrally through the breech block, and is driven forward on the center of the cartridge by a blow of the hammer.

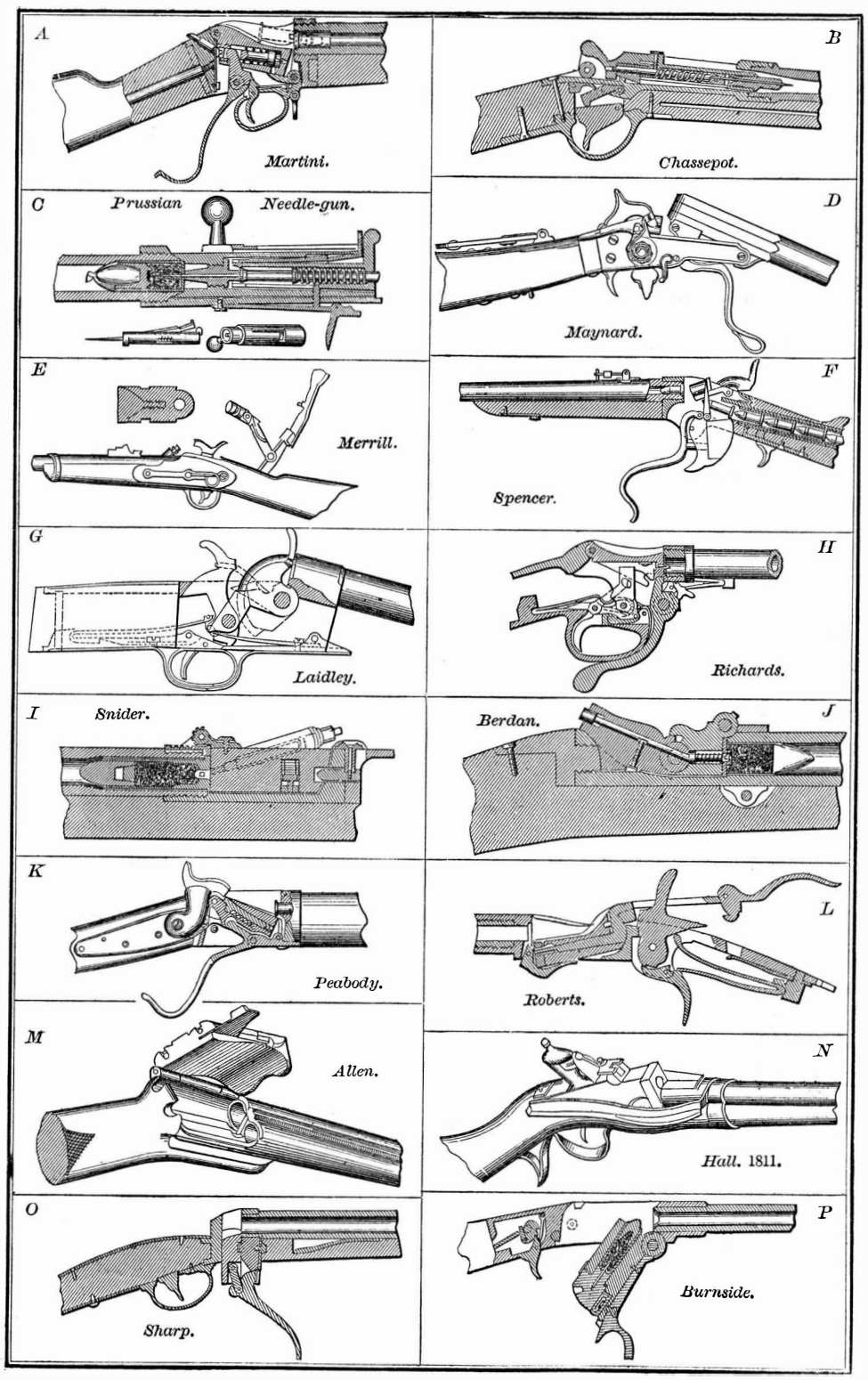
Allen's gun, M, is double barreled, and the breech block is hinged at the side, swinging upwardly and laterally. It carries both firing pins, and is locked shut by a latch.

The first patent in the United States for a breech-loading firearm was to Thornton & Hall, of North Yarmouth, Mass., May 21, 1811. This gun is represented at N in our engraving, and had a breech block, which was hinged on an axial pin at the rear, and tipped upwardly at front to expose the front end of the charge chamber. The flint lock and powder pan were attached to the vibrating breech block.

Sharps' rifle, O, has the barrel rigidly attached to the stock, the rear being opened or closed by a vertically sliding breech block, which slides up and down in a mortise operated by the trigger guard, which is pivoted at the front end, or by a lever. The primer consists of small pellets of fulminate inclosed in a copper casing so as to be waterproof. These are placed in a pile in a hole in the lock plate, forced upward by a spiral spring, the upper one fed forward by a plunger, caught by the cup of the hammer, and carried down upon the nipple. The cartridge is in cloth, the end covered with tissue paper saturated with saltpeter, through which the fulminate will ignite the powder.

Burnside's rifle, P, has the barrel attached to the stock, the breech piece being pivoted beneath the barrel, so as to swing downward and expose the chamber in the front end of the breech piece for the insertion of the cartridge.

Other forms of breech-loading rifles will be illustrated in forthcoming issues of this journal.



BREECH-LOADING FIREARMS.

*Published in numbers by Messrs. Hurd & Houghton, New York city.

Imitation Marble.

Carl Boschau says that if a statue, made of plaster of Paris or *papier maché*, be coated with thick white dammar varnish, and then dusted with pulverized glass, it will have, when dry, the appearance of alabaster. If it be afterwards varnished a second time, and dusted with coarsely pulverized white glass or mica (*marienglas*) and again dried, it will be a very successful imitation of Carrara marble, especially if the marble veins be first traced on it with some delicate blue pigment. This method of preparation follows that of Nature, for alabaster consists of very small crystals of sulphate of lime, and Carrara marble of somewhat larger crystals of carbonate of lime, which in reflected light glisten like white sugar. This effect is obtained with perfect deception by the brilliant white glass in coarse powder.

An Oil Pipe Three Hundred Miles Long.

The Pennsylvania Transportation Company, of which Mr. Henry Harley is president, has been chartered by the State of Pennsylvania for the purpose of transporting oil from the oil regions to the principal Atlantic seaboard cities. The plan proposed is to run the oil through a four inch pipe laid on the surface; the forcing power will be 900 lbs. to the square inch; there are to be stations at distances of fifteen miles, at each end of which an engine of a 100 horse power will be erected to work a pump to continue the flow from point to point. The company having decided upon the construction of the work, the president sought the services of General Herman Haupt. He pronounced the scheme, after a thorough examination, to be entirely practicable, and is now acting as engineer-in-chief. In view of the enormous product of oil in this country—30,000 barrels per day—and the rank it now holds among the leading articles of export, coupled with the exorbitant charges for railroad carriage from the wells to the seaboard, by the completion of the enterprise and its successful operation a complete revolution will be accomplished in the handling of this article. As a proof of how valuable this traffic has been to the several railroads over which the oil has been borne, it is only necessary to say that up to the present time the railroad charges aggregate $79,000,000. The minimum cost of transporting oil by rail is 50 cents per barrel, and the minimum cost by the pipe process is 16 cents. The average charge by rail is $1.25.

The estimated cost of the entire work, including fixtures, etc., is $1,250,000; and considering the difference in cost between this method and that by rail, upon the hypothesis that the company will discount at least 25 cents a barrel on rail rates, it will readily be seen that, with all the expenses of operating, the first year's earnings will pay the first cost of the work. The Pennsylvania Company is the parent company, but there is also the Baltimore Transportation Company, chartered by the State of Maryland, and some five other companies are expecting to unite. The first objective point or terminus will be Baltimore, as being the most feasible and direct route for the pipes. Following which other termini will be established in Philadelphia, New York, etc.

The pipes being laid on the surface, and there being no obstacle in the way of forcing the oil to any hight, the line will literally be an air line, and the distance from the oil regions to Baltimore is 300 miles. The oil will be distributed from the pipes into immense reservoirs, with refining establishments adjacent. Of course the whole railroad system will oppose it, for it is taking from them a traffic from the very nature of which there could be no competition; but the advantage to the oil producers, who will have the entire control, will be immense, and the advantages which will accrue from such facilities to this important branch of our export commerce will be incalculable.

The feasibility of this enterprise, so far as the passage of the oil through pipes is concerned, has been fully established by the present system in operation in the oil regions, where the aggregate length of the pipes conveying the oil from the several wells to the reservoirs is nearly 250 miles. —*Boston Traveler.*

Prizes for a New Bleaching Agent.

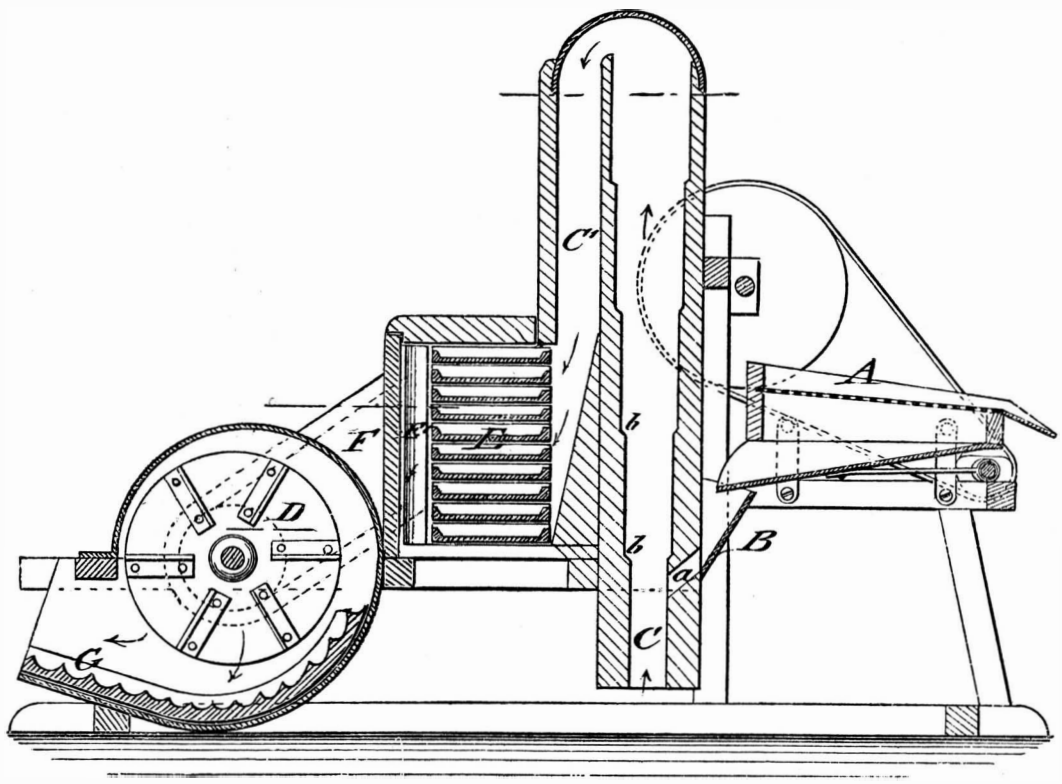
A Vienna industrial league offers a silver medal to any one who will discover a method of bleaching every kind of silk perfectly white without the use of sulphur or other chemical injurious to silver. In embroidery and silver lace, where silk and silver are used together, the silver is blackened by the sulphur in the silk. A similar prize is offered for the most beautiful and solid domestic article for weighting light-colored silks.

TO MAKE a good organ pipe metal, take equal quantities of tin and lead, cast into sheets, and plane smooth.

© 1876 SCIENTIFIC AMERICAN, INC.

IMPROVED AMALGAMATING APPARATUS.

The improved apparatus illustrated herewith is for separating gold from sand and other impurities by means of a suction blast. A represents a reciprocating screen, on which the gold-bearing sand is placed. The bottom of the screen is inclined in opposite direction to the perforated part, and conveys the material into a hopper, B, of the upright suction tube, C, from where it passes through an aperture, *a*, into the lower part of the same to be acted upon directly by a suction blast from below, the blast being created by a suction fan, D. The air enters through the open bottom end of the suction tube, which is made with inclined steps, *b*, that produce the gradual widening of the tube toward the top end. These steps serve to throw the sand, dirt, or other substances that slide down at the side of the tube back into the current of air, to be acted upon and carried in upward direction. The heavier gold particles drop down into a suitable receptacle below the bottom opening of the suction tube, while the lighter ones pass with the sand along the semicircular top part of the tube, and over the partition wall into the downward extending tube, C′, that conveys the sand, in connection with a steeply inclined bottom, to a series of amalgamating pans, E, that are filled with quicksilver, and placed so closely together that the total width of the narrow spaces or interstices between the pans is equal to the width of the entrance opening of the suction tube. The gold-bearing sand is thus carried with considerable power through the spaces between the pans, the fine gold particles being absorbed by the passage in close proximity, and the affinity to the quicksilver.



IRVIN'S AMALGAMATING APPARATUS.

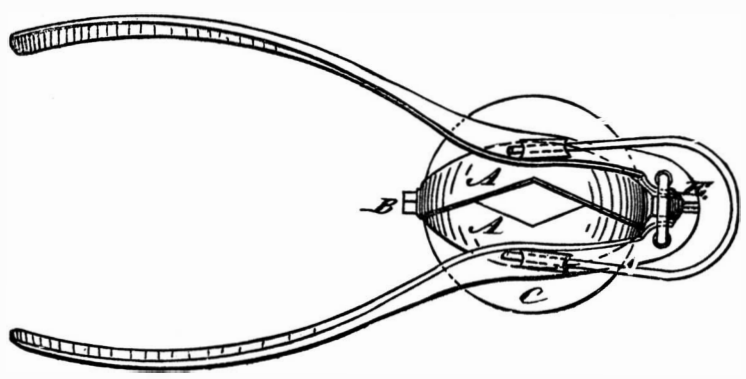
A central tapering partition, E′, at the opposite side of the pans, divides the current and conveys the sand sidewise through the side ducts, F, to the center of the suction fan, from where the same is thrown by centrifugal power on a curved and tangential fluted pan, G, at the bottom of the fan casing. The remaining particles of gold are amalgamated in the fluted pan, and the light impurities thrown to the outside of the casing. Thus the gold particles are separated in their course through the apparatus, the heavier ones being dropped in the suction tube, while the lighter ones are amalgamated in the pans, and the remaining ones, that are mechanically carried along, in the fluted pan at the mouth of the fan casing.

This machine was patented through the Scientific American Patent Agency, July 4, 1876, by Mr. Thomas W. Irwin, of Port Madison, Wash. Ter.

NEW LAMPWICK TRIMMERS.

Mr. John Bannihr, of Hempstead, N. Y. has patented (July 4, 1876) through the Scientific American Patent Agency, a novel improvement in lamp wick trimmers, which is represented in the accompanying engraving.

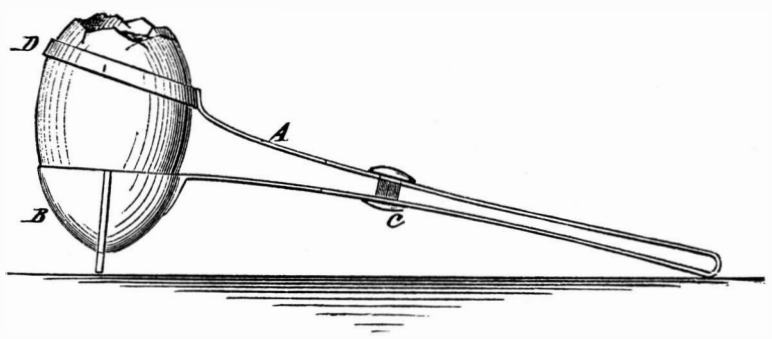
The shear cutters, A, are contrived to cut alike and at the same time from both edges of the wick to the center, whereby the wick is trimmed better and more uniformly than when cut across from one edge to the other. The cutters, which are curved for trimming the wick in form for an oval burner, are extended down at the ends a suitable distance below the point of cutting, and pivoted together at both ends, B, and also to a supporting ring, C, that rests on the burner some distance below the top for a steadying support, and for a gage to govern the hight of the cutting above the top of the burner The levers for working the cutters are pivoted to the standard, E, mounted on the ring, C, and are connected to the cutters at the center between the pivots, B. The edges of the cutters are shaped in the form of two sides of a triangle, the apex of which is at the center of the cutters lengthwise, thus enabling them to shear-cut the wick from its edges to its center.



BANNIHR'S LAMPWICK TRIMMER.

A NEW EGG HOLDER.

The annexed engraving represents a simple egg holder, devised by Mr. Henri Guilbeault, of New York city, and to him patented through the Scientific American Patent Agency, July 4, 1876. It consists of a cup, B, of suitable form, with a ring, D, and spring tongs, A. The parts are combined, as shown. in such manner that an egg placed in the cup may be securely held by bringing the ring down upon the egg by sliding a double button, C, which connects the jaws of the tongs, through slots made in them for that purpose. The egg is thus held while it is being eaten from the shell.



GUILBEAULT'S EGG HOLDER

A New Chicago Rolling Mill.

The Joseph H. Brown Iron and Steel Company, of Chicago, are nearly ready to begin operations in their merchant mill. All finishing trains, except the 22 inch beam mill, are ready to operate, except making steam connections. The puddling and heating furnaces are ready to work and the boilers in place. The bar mill and 9 inch train are in position, as well as the top and bottom mill. They are building a blast furnace 18 feet by 80 feet. This will be, when completed, one of the most complete establishments in the West. It has six double puddling furnaces (Siemens) with a daily capacity of eight tuns each on double turn; two scrap furnaces (Siemens) with a capacity of 20 tuns each per day; and five Siemens' heating furnaces, 32 gas producers, a 22 inch beam mill to roll 90 feet long; 16 inch bar, with six stands of rolls; 9 inch guide; 20 inch top and bottom mill; 20 inch muck train · all these are three high. There are sixteeu 40-inch boilers, with 40 3-inch flues in each. They also have drawings for a complete Bessemer plant.—*Iron Age.*

Purifying Carbon Disulphide.

Recent chemical investigations seem to have included the whole range of photographic materials, and, in addition to those already named, we find our notes call attention to a mode of purifying the most useful material for dissolving india rubber—carbon disulphide. In the state most commonly presented, it possesses such an intensely fœtid odor as to make its use unbearable; the new process promises a product in a very pure condition. The method of purification consists in mixing fuming nitric acid with a sample of the disulphide distilled off palm oil, and then adding distilled water, filtering, and distilling between 50° and 60°. A peculiar violet compound produced at one part of the process has been traced to the iodine well known to be almost always contained in commercial nitric acid.

The Jetties.

The progress of work on the Mississippi River jetties has gone so far that Captain Eads was recently enabled to close up Grand Bayou, a channel that has heretofore drawn off about one third of the water of the South Pass. The closing of this bayou so increased the current through the Pass that in less than two days the channel was deepened more than a foot through the greatly increased scour. Captain Eads thinks that this will soon tell on the main bar; and in fact the pilots say its effect is already so marked that they can take over the main bar any vessel drawing twenty feet of water. If this be the case, the work on the jetties has already accomplished much more for the South Pass than many years of laborious and expensive dredging have been able to do for the Southwest Pass.—*Philadelphia Ledger.*

The Resources of Animals.

Animals, even of the least important species, sometimes resort to shifts and expedients, to defend and support their existence, so curious as to astonish even those observers who are most familiar with their habits. The little gossamer spider, having no wings, still finds its home in the upper air. Weaving a tiny kite of web and flying it aloft by unwinding a thin kite string from its spinneret, it finally fastens the lower end to a twig, and climbs fearlessly up the filament, till at last it sits far above the earth and catches midges upon its floating raft in the air. This little forager has been found sailing in the air nearly a mile high by balloonists!

The male spider has usually a very poor show for liberty or even for life. Small and lean, weak and cowardly, a mere speck by the side of his big blushing sweetheart, she generally catches him when he first comes courting, spears him with her fierce mandibles, gnaws the quivering flesh off his bones, and flings his polished skeleton into the sewer. She is heartless and ferocious—a coquette and a warrior. Woman's rights are carried to an extreme. The husband is not allowed to vote or to govern his own family. Before his brood of 1,000 children have climbed merrily upon their mother's back, she has generally made a breakfast off him, and his bones bleach in the back yard.

Then there is the hermit crab, the pugnacious crustacean that can seldom succeed in preserving its own life at all except by finding the shell of some large snail or whelk to crawl into. Having a bulky and soft abdomen, it is peculiarly vulnerable to attack from predacious fishes and crabs, and its only safety is in covering its salient extremity. If it finds an eligible snail shell empty, it immediately takes possession by backing its exposed body in and fastening the shell on by the posterior hooks, leaving its head and legs outside. Then it drags the shell around till it is outgrown, when it seeks another. If it finds none unoccupied it frequently kills a living snail, eats him, and unceremoniously takes possession of his house. Or it attacks a tenant crab, the winner of the combat retaining the premises. The loss of an eye or a claw is by no means a mortal injury, or even a permanent crippling, as the mutilation heals, and the eye or limb reappears as good as ever.

Speaking of crustaceans, did you ever see a long or soft-shell clam in his native wilds? Do you know what that exposed proboscis is which you call the neck? It is a double-acting muscular pump, with two pipes and valves, through one of which salt water is drawn and through the other expelled. It drenches the gills, which retain as food any bit of nutriment that may float in, when the filtered water is passed out through the other valve. And that dark lump in the clam, which you have often rejected, madam, as the stomach, is not the receptacle of food at all, but merely an excellent enlarged liver, which epicures might, without torturing the humble bivalve, make into a *paté de foie gras.*

Most animals that are in danger from predacious foes are of a natural tint, resembling the hues of the earth or trees upon which they live. Partridges, quails, and other sand and heath birds are brown, like their dwelling place, and the color serves to conceal and protect them. Some butterflies and locusts are exactly the shape of the leaves of the tree upon which they cling, so that they are not visible in their true character. Where a hundred have settled you cannot see one, only the leaves clinging to the branches and swaying in the wind. Not only the color of the leaves is imitated, but the venation, to the most minute particular; and it is only when you strike the bush with a stick that the "leaves" rise and flutter away. Some of these leaf insects, as they are called, change their colors with the season of the year—green in spring, brighter in summer, and brown in autumn, like the true leaf. Even the imperfections of the leaves are mimicked—those characteristic markings and erasions of the leaf which result from the attacks of minute insects. The decay of dying leaves is so imitated that, as Mr. Wallace remarks, "it is impossible to avoid thinking, at first sight, that the butterflies themselves have been attacked by real fungi."

In the turbulent brooks of Connecticut, and probably of other States, is found an ingenious little insect, that the rural people know as a bundle-bug, an inch or two long, which protects itself

© 1876 SCIENTIFIC AMERICAN, INC.

from predacious fishes by gluing to his sides small sticks, somewhat longer than his body, until he is encased in an irregular wooden cylinder—a jagged and clumsy boat in which he alternately floats and crawls. This carpenter worm leaves an orifice for his head and legs, and his artificial shell seems a thorough shield.

The medusa or jelly fish of our seacoast is well known to all sea bathers; and its phosphorescence often reveals its whereabouts to steamboat travelers. It is as large as a tea plate, flat, gelatinous, and translucent; with the convex portion forward, it pushes its way through the water as if it were a small parasol—a white fringe a yard long, waving backward from the edge, assisting the resemblance. This creature has hardly any life; it seems to have only one organ, which receives and ejects food, and its movement through the water is by a series of convulsive jerks. Lift it out of the water and it drops through the fingers like thin jelly. But in its native element it has the power of sharply stinging with its fringe, from which it is called nettle fish. This fringe, when microscopically examined, is found to be filled with minute sacks, each of which contain a microscopic arrow ready to discharge. Friction bursts the cells and causes the discharge of myriads of arrows into any soft flesh that may be the cause of the disturbance. The harm is not great to any robust organism, but it must be sufficient to shock and paralyze some of the inferior fishes.—*Graphic.*

Correspondence.

How to Straighten a Shaft.

We frequently receive letters from our subscribers detailing some experiment they have made, or some new wrinkle in the detail of manufacture, or concerning a novel device they have found to answer for some particular purpose; for all such communications our correspondents have our thanks.

Although the large number of such communications precludes the possibility of our answering or publishing all, yet we convert as many as possible to the benefit of our readers. We are sometimes surprised to observe how completely the information forwarded to us on a given subject will answer an inquiry made on the same subject by some other correspondent. For example, A. F. writes: "You will do me a great favor if you will tell me how to straighten an iron shaft, 2½ inches in diameter, that is slightly bent, and will not work without binding in the bearings."

The same mail brought a letter from J. J. H., who writes:

To the Editor of the Scientific American:

"The following is a good way to straighten shafts that have been sprung by heat or otherwise. Lay the shaft on bearings at each end, with the arched side up, about 1 foot from the ground; then build a fire (wood will answer) under the part or parts to be straightened. When hot, chill the the top side, which is to be straightened, with water, which can be best done with a swab; continue the heating and chilling till the work is complete. Allow the heat to come back to the top side between each chilling, to quicken the process, and to ascertain when complete. After the shaft is hot, a very little fire will be required to continue the heat. I think that any kind or size of metal shafting can be straightened by this process. I made the experiment on a wrought iron shaft 5 inches in diameter and 12 feet long, that was sprung 3 inches by being burnt in a mill. It was was only 2 hours from the time I built the fire under it till it was perfectly straight. J. J. HILL.

Hayden's Ferry, Arizona, July 1, 1876.

[For the Scientific American.]

THE DEVELOPMENT OF SPEECH.

As the seventeenth century was preëminently one of revolutions, the present is one of evolution. Everything is supposed to have been evolved from something else, man from monkeys, articulate speech from inarticulate cries, writing from hieroglyphics, etc. A few weeks since the American Philological Society met in New York city, and among their discussions were some of much interest. Professor Harkness read a paper in which he stated that comparative philology had proved that all the known languages and dialects have been evolved from one parent tongue, whether by differentiation, natural selection, and survival of the fittest, or by other processes. Darwin, in his "Descent of Man," draws some of his most forcible arguments from the resemblance of the human fetus to the full grown ape and other animals. The unspoken language, the inarticulate cries of infants, has not, so far as we are aware, been carefully studied, and compared to the cries of birds and animals. H. Taine has recently directed attention to this subject by an article on "Lingual Development in Babyhood," published in the *Revue Philosophique.* But M. Taine passes over the multitude of different cries and exclamations, consisting, as he says, exclusively of vowel sounds, and expects articulate speech. Some of his observations are, however, valuable and interesting, as being the first that have been accurately made and intelligently recorded. We hope that these observations will be repeated by others, so that in time the mass of facts will be large enough to enable us to generalize upon them, and eliminate the personal factors which vitiate the conclusions drawn from too limited a number of facts. Idiosyncrasies in children are probably as common as elsewhere; abnormal development must not be mistaken for a normal condition; one child will differ so greatly from some other child that we shall at first incline to think there is no common ground between them; but as observations increase, the facts will gradually fall into system, and order come out of chaos.

From a study of the speech of babyhood we shall learn not only how language is formed, but shall see in it the gradual unfolding of the intellect. Babies' selections of words are instructive to the biologist; the order in which they acquire the power of pronouncing the consonants is an interesting study for the phonetic scholar. Why, for instance, can every infant pronounce the word no, for several months before it can say yes? That the English sounds of th are difficult for our children is not surprising; but why are our sounds of j and ch, which few foreigners ever succeed in uttering correctly, easier for a child to pronounce than w, or f, or g? Yet we have heard a boy of three years say jay for way, chun for fun, and jajy for wagon. Again, an American child, who has heard no language but English, will sometimes introduce into our words the most difficult vowel sounds of other languages, such as the unpronounceable German ö and ü, or French eu and u, which he has never heard.

M. Taine says that the little girl on whom his observations were made began to attach a meaning to certain words before she pronounced any word to which she attached any meaning. This will, we think, agree with the experience of most parents, and is not strange, for animals learn to understand our language which they can never speak. The first word pronounced by her was papa, but for a time she did not comprehend its meaning. At the age of fourteen months and three weeks, he says, she could pronounce mama, tété (nurse), oua-oua (dog), koko (hen, cock), dada (horse wagon), mia (cat), kaka, and tem. To the latter word she gave a very extensive signification, such as give, take, see, look; it seemed to be a word coined to express her principal desires. Another child, observed by the writer, began with the word no, which was spoken very emphatically in reply to any question, and without a definite idea attaching to it. The same may be said of another common expression used by her, "don't do it;" she soon after learned to say mama, bow-wow (dog), and dink (drink). At the age of fifteen months she began to imitate, repeating almost everything she was told to, and here the habit of generalization was again apparent. She was told, on seeing an ice wagon pass, to say ice. She can pronounce it nicely, and says it every time she sees a horse and wagon, showing that she has extended its meaning to all wagons, and probably to horses also. Another curious case came under our notice sometime since of a little boy who applied the term dady to every man he saw, and also to chickens, dogs, horses, etc., much to the annoyance of his mother.

In a paper read at the Bristol meeting of the British Association, D. A. Spalding advanced the idea that the progress of the infant is but the unfolding of inherited powers. He makes no application of this principle to the power of speech, although he might have done so, and we are inclined to believe that, just as a child learns to walk as soon as his limbs are strong enough to safely support him, so he will learn to talk as soon as the brain is sufficiently developed to evolve ideas requiring expression, subject, of course, to the law that perfection is only gained by practice. E. J. H.

[For the Scientific American.]

THE FIRST CHINESE RAILWAY.

The Japanese have readily taken to the mechanical, scientific, and other improvements to which intercourse with the rest of the world has introduced them. For ages they were more exclusive than the Chinese; but now that the barrier is broken down, the Japanese make the most of their opportunity; and they really seemed to have learned and adopted more foreign notions in a few decades than the Chinese have acquired in centuries.

But the iron horse has at last been domesticated in China; and if the old conservatives of the Celestial Empire ever read anything but Chinese classics, they would class the locomotive with that wooden horse which stands as the representative of treacherous gifts. If the locomotive does not revolutionize China in the end, its power has certainly been overrated. The trial trip was taken on a short road out of Shanghai, on June 30 last, and on July 3 regular travel commenced, six trains running each way daily, and the receipts being highly satisfactory. Six daily trains over a road only five miles long is not a very heavy day's work; but with the Chinese, in making innovations, it is wise to make haste slowly.

The first railroad in China, from Shanghai to Woosung, is ten miles long; but the road was only completed to Kang-wan, half the distance, when it was opened with much ceremony, the pleasantest part of the programme being on the second day, when the natives were allowed to travel free, and appear to have received that proposition as heartily as any dead heads among the outside barbarians could have done. It is three years or more since the British and continental ironmasters, in session at Liége, took China into their calculations as a possible market for iron, locomotives, cars, and all the mechanical paraphernalia of railways. The first idea was to present the Emperor of China with a small specimen railway; but Chinese red tape—as much more complicated as a Chinese puzzle is more puzzling than any other—prevented the plan from being successful. The next movement, and it would seem a feasible one, was for the foreign residents to buy ground for a carriage road, from Shanghai to Woosung. Englishmen must have their drives, and there could be no harm in that. Then railroad estimates were made; but the first were at too high a figure. It would not do to risk much on an enterprise upon which the Chinese dragon might pounce, and, with a whisk of his tail, demolish. So the estimates were cut down to a single track, of very narrow gage, 2 feet 6 inches, very light rail, 27 lbs.; a toy locomotive, weighing only 1½ tuns, running at a maximum speed of only 15 miles per hour. The road was commenced in January, and in the months which have elapsed the projectors have gained in confidence. They have built for the road two engines, the "Flowery Land" and the "Celestial Empire," weighing each 9 tuns; they have eight inch cylinders and ten inches stroke, have each six wheels, and side tanks.

With a sagacious eye to the consequences of an explosion upon the Chinese temperament, the boilers were tested to 200 lbs. to the square inch. And, for a little while at any rate, the speed will be kept down, and the chances of collision or track jumping will be studiously guarded against. Even to cut off a Chinaman's queue would be fatal to the enterprise; and at this late day in the history of railroads, the problem of safety is made prominent above that of speed. It were much to be wished, for the sake of the public, that Britons and Americans were so far Chinese that to kill one would be a disaster worth consideration, as well financially as morally. If we learn safety in railway traffic from the first Chinese railway, it will be a first class investment for the traveling world. And if, from this small beginning, the iron interests should receive a much needed impetus, that, too, would be a welçome event. *

THE IMPACT OF LIGHT.

ABSTRACT OF A LECTURE BY CAPTAIN ABNEY, R. E., F. R. S., AT THE LOAN COLLECTION, SOUTH KENSINGTON.

Astronomy was the religion of the world's infancy, and it can hardly be a matter of surprise that untutored yet inquiring minds, unaided by any distinct revelation, should have attributed to the glorious orb, the center of our solar system, the possession of divine attributes, and, as they gazed upon the wondrous effects of his magical painting, that they should have offered to him their adoration and worship, and carefully noted any phenomena due to him. Thus probably

THE FIRST PHOTOGRAPHIC ACTION

noticed would be at a very early period of human existence, when the exposure of the epidermis to his rays caused what is known to us as tan, whilst the parts of the body covered would remain of their pristine whiteness. A photographic action which would be remarked at a later date would be the fading of colors in the sunlight. Ribbons, silks, curtains, and similar fabrics of a colored nature undergo a change in tint when exposed to it.

RIBBONS CHANGED BY LIGHT.

I have here a specimen of a pink trimming used by the fair sex, and the lady who presented me with it informed me that it was "a most abominable take-in," as the color "goes" after two days' wear. Her ideas on the subject and my own somewhat differed, for to me it presented a capital opportunity of using the material as a means for obtaining a photographic print in a moderate time I have here two results of the exposure of this stuff to the sunlight. One was exposed beneath a negative of an anatomical subject, and we have the image represented as white upon a pink ground. The other subject is a map. An ordinary map was superposed over a square piece of the stuff, and placed in sunlight whilst in contact. We have in this case the lines of the map represented as pink on a white ground, from which the color had faded.

CHEMICAL CHANGES CAUSED BY LIGHT.

The general opinion is, I believe, that the color is given off somewhat similarly to the scent from a rose. Were this entirely the case, the light would not act as it does, but, beneath the negative or map, the color would bleach uniformly.

The bleaching seems to be a really chemical change in the dye, due to the impact of light. There are many other bodies besides dyes which change in light, and some of them are of the most unlikely nature. I had intended to show you to-night the change that takes place in glass by exposure to light for long periods. My friend, Mr. Dallmeyer, has in his possession specimens of brown and flint glass, which have markedly changed color in those halves of the prisms purposely exposed to solar influences. In some cases there is a "yellowing" of the body, and in others a decided "purpling."

WHAT LIGHT IS.

It is, however, only those bodies which change rapidly in the light that are utilized in photography. The most common amongst these are various compounds of silver, for they are peculiarly sensitive to the action of light. Nearly every silver compound is more or less changed by it, and when I say changed I mean altered in chemical composition When we reflect what light is we can better understand its action. Light, as experiment, confirmed by mathematical investigation, tells us, is caused by a series of waves issuing from the luminous source, not, indeed, trembling in our tangible atmosphere, but in a subtler and infinitely less dense medium, which pervades all space, and which exists even in the interior of the densest solids and liquids. These waves of ether, as this medium is called, batter against and try to insinuate themselves amongst the molecules of any body exposed to their action, a good many millions of millions of them impinging every second against it. Surely it is not surprising to think, small though the lengths of these waves be, that this persistent battering should in some instances be able to drive away from each of the molecules some one of the atoms of which they are composed.

HOW LIGHT ACTS UPON SILVER CHLORIDE

Take as a type that salt of silver which was, perhaps, the first known to change in the presence of light-silver chloride. For our purpose we may represent each of its molecules as

© 1876 SCIENTIFIC AMERICAN, INC.

made up of two atoms of silver locked up with two atoms of chlorine. Let us consider the action of the light on only one molecule. The waves strike against it energetically and persistently; the swing that the molecule can take up is not in accord with the swing of the ether. It is shaken and battered till it finally gives up one atom of chlorine; the vibration of the remaining two atoms of silver and one of chlorine are of a different period, and are not sufficiently in discord to cause a further elimination of an atom. The molecule which contains the two atoms of silver and one of chlorine is called a sub-chloride of silver or argentous chloride, and is of a gray violet color. If, then, I place silver chloride (held in position by a piece of paper) beneath a body, part of which is opaque and part transparent, and expose it to sunlight, I shall find that, where the opaque parts cover it, there the white chloride will remain unchanged, whilst on the portions beneath the transparent parts, the dark silver sub-chloride will have been formed. Of course were the paper, after removal of the body, to be further exposed to light, the image obtained would disappear, as a blackening over the whole surface would ensue. In this state, then, the print is not permanent. Fortunately for photography, a steady solvent of silver chloride was found by Sir John Herschel in sodium hyposulphite. On applying this salt to the ima e, it was removed, and also one atom of silver and one of chlorine from the sub-chloride molecule, leaving the atom of metallic silver behind. The chemical change that takes place on the silver chloride can be very distinctly shown by exposing it perfectly pure beneath water. The presence of the sub-chloride is shown by the color, and that of the chlorine can be exhibited by the usual chemical tests.

ACTION OF LIGHT ON ALBUMINATE OF SILVER.

In making an ordinary silver print on paper, we have, however, something more present than silver chloride; we have an organic salt known as the albuminate of silver, that is, a combination between albumen and silver. I have in this test tube a little dilute albumen—the solid constituent of the white of an egg. Into it I drop a little silver nitrate: a flocculent precipitate is at once apparent. The silver from the nitrate has combined with the albumen, and on burning a piece of magnesium wire before it the outer surface shows a darkening; evidently, then, the albuminate of silver is decomposed by light. For silver printing purposes, paper is coated on one surface with a solution of albumen and sodium chloride, and the production of the silver chloride and albuminate is effected by floating that surface on a solution of silver nitrate. When dry, the paper, which is now sensitive to light, is ready for exposure beneath a negative. Here we have two prints produced on paper so prepared. If now I take one of them and dissolve away the insoluble salts in sodium hyposulphite, you see that the color is of a disagreeable foxy red tint. To show you how this want of a pleasing tone may be overcome, the other print is immersed in a weak solution of gold, and by a well known chemical action the metallic gold is deposited on the darkened portions of the picture. Now when gold is precipitated, it has not the well known yellow color, but is a bluish purple; thus the deposited gold mixes its peculiar tint with that of the silver, and after immersion in the hyposulphite we obtain a print whose beauty cannot be surpassed.

THE MAGIC PHOTOGRAPH

I daresay that many of you may have been charmed with the production of magic photographs, as they were called. Some few years ago the sale of such was enormous, but now the curiosity of the public seems to be satiated. The magic, as you may be aware, consisted in being able to produce on a white piece of paper a photograph of some unknown object. These mysterious pieces of paper were generally supplied in packets, containing with them a piece of blotting paper. The directions stated that the blotting paper was to be damped, and while moist, to be applied to the surface of one of the accompanying pieces of blank paper, and then a photograph would shoot out. I will endeavor to show you one method of their production. Here I have an ordinary photographic print which has not been treated with gold, but merely immersed in sodium hyposulphite and then washed. I immerse it in a solution of mercurous chloride which I have in this dish, and immediately a bleaching action is set up. The action continues, and the paper is apparently blank. What has happened? Simply a white compound of silver and mercury has been formed, which is indistinguishable from the paper. If I wash the paper and dry it, it is in the state of the paper supplied in the packets. I have one here washed and dried, and I immerse it in the sodium hyposulphite. The image immediately reappears, a combination has taken place between the constituents of the hyposulphite, the mercury, and the silver

Need I say that the blotting paper supplied is impregnated with the same sodium salt? In damping it the molecules of the latter are so separated and mobile that they are free to combine with the white image. By similar treatment the picture may be made to again disappear and once more reappear

LIGHT AND FERRIC CHLORIDE.

Besides silver there are various other metals which will give a photographic image. This paper, which has a slightly yellow tint, has been brushed over with ferric chloride, more commonly known as perchloride of iron, in which we have the maximum number of colors of chlorine combined with metallic iron. Allowing ordinary white light to act upon it, the waves cause a disturbance between the iron and the chlorine atoms, and one of the latter is shaken off, leaving ordinary ferrous chloride, or muriate of iron, behind. A piece of paper, similarly prepared, has been exposed beneath a negative, and the reduction of the ferric chloride to the ferrous state can be demonstrated by floating it on a solution of potassium ferricyanide. The combination between the lowest type of the iron salt and this salt results in the formation of a deep blue precipitate, known as Turnbull's blue. You see, after applying it, we have the lines of this map, of which this is the negative, of an intense blue. Instead of demonstrating the change of the iron salt by this means, I may float it on a weak solution of silver nitrate. The ferrous salt of iron will reduce the silver, while the ferric salts are wholly inoperative to produce the same effect. Here we have such a print.

The principal investigator of the action of light on iron compounds was Sir John Herschel, and he employed a variety of different combinations. Perhaps one of the most interesting exhibits in the photographic section is that old list of Fellows of the Royal Society, on which were pasted, by the hand of that distinguished philosopher, the actual solar spectrum prints made during his researches on these and other metallic salts.

URANIUM LIGHT-SENSITIVE SALTS.

Uranium salts are also capable of being reduced to less complex forms by the action of light. I will not enter into a detailed description of the decomposition, but will simply exhibit the method of producing a print with the salt. The paper has been coated with uranic nitrate and exposed to light, beneath the same negative before shown to you. The image is made visible by a solution of potassium ferricyanide as in the case of the iron salt.

In the cases of photographs are shown some interesting specimens of iron and uranium prints, made by Niepce de St. Victor. I believe they were presented to Sir Charles Wheatstone by that ardent experimentalist. The subdued brown tones of the latter were probably obtained by the admixture of a little iron with the uranium.

PLATINUM PICTURES.

Within the last couple of years the salts of iron have been put to practical photographic printing purposes by Mr. W. Willis, jr., of Birmingham, and a valuable process resulted from his labors. The sensitive salt employed is an organic salt of iron known as ferric oxalate, and Mr. Willis made the discovery that among other metals platinum could be reduced to the metallic state from a double chloride of potassium and platinum, by ferrous oxalate in the presence of a potassic oxalate. A piece of paper is floated on a weak solution of silver nitrate and dried; and over the surface is brushed a mixture of the platinum salt and the ferric oxalate. After exposure to light (which produces the ferrous salts) beneath a negative, the paper is floated on a solution of neutral potassium oxalate, when the image at once appears formed of platinum black, a substance at once durable and incapable of being acted upon by atmospheric influence. Such an exposed paper I have here; and floating it on oxalate solution, you see the image is immediately developed. The unreduced iron salt can be eliminated by soaking the print in the oxalate solution, and a rinse and hyposulphite removes all traces of silver nitrate. After a few changes of water, the print may be dried, and is permanent. I should explain that the paper is first coated with silver nitrate in order to cause the platinum to adhere firmly to the surface of the paper. When omitted, the fine black powder formed is apt to precipitate in the bath.

VANADIUM.

Before dwelling upon that metallic compound which in photography is next in importance to silver, I must call your attention to the first vanadium print ever produced. Professor Roscoe, who has already delighted an audience in this room with an admirable lecture on Dalton's apparatus and what he did with it, has made a classical investigation of the compounds of this metal, and among other interesting facts has noticed that the vanadium salts are reduced by light in a somewhat similar manner to uranium salts.

LIGHT AND POTASSIUM DICHROMATE.

We now have to consider the printing processes which are due to the action of light on the dichromates of the alkalies in the presence of organic matter. For our purpose to-night we may take as a type potassium dichromate, a salt which readily parts with its oxygen to those compounds that have an avidity for it, more especially to certain carbon compounds under the influence of the ether waves.

To show that this salt is thus easily reducible by light in the presence of organic matter, I have here a piece of paper which has been brushed over with it, and exposed beneath a print. For a moment I float it on a weak solution of silver nitrate. The brilliant crimson color of the part not exposed to light tells us that silver dichromate has been formed; but where the solar rays have acted, the color remains unchanged. A slight modification of this process now exhibited to you is known as the chromatype, the offspring of Mr. Robert Hunt, so well known in the scientific world for his researches on light.

THE WONDERFUL ANILINE PROCESS

While experimenting with the chromatype process, Mr. W. Willis, the father of the gentleman I have already mentioned, discovered what is known as the aniline process. It is based on the fact that an acid in the presence of potassium dichromate strikes a blackish green or red color when brought in contact with aniline. You will see the *modus operandi* when I say that paper is floated with potassium dichromate and a trace of phosphoric acid. Aniline is dissolved in spirits of wine, and the mixed vapors allowed to come in contact with the sensitive paper that has been exposed beneath a positive print, such as a map or plan. The impact of the light has so changed the potassium salt that the aniline vapor causes but little coloration, while, where the paper has been protected from it, the dark color indicates that the dichromate is unchanged. The formation of this black color is familiar to the manufacturers of aniline colors, being, I believe, similar in composition to the residue left after the formation of aniline purple by Mr. Perkin's method.

It should be noted that, for copying engineers' tracings and drawings this process is extremely valuable, as there is no occasion to take a negative on glass before obtaining a print. All that is requisite is that the original should be fairly penetrable by light. A piece of paper prepared as indicated, a sheet of glass to place over the plan, and a box in which to place the exposed print to the aniline vapor, are the only necessary plant for the reproduction of a design.

What is an Ingrain Carpet?

The two-ply ingrain known to the trade is a fabric composed of two webs, or "plies" of cloth, made with different colored yarns—say one "ply" green, the other red—of equal consistence or texture, u nited at the edges or selvages of each by the selvage threads, and ingrained or united at different parts of the cloth, wherever called for by the design or pattern. If the red "ply" represents the ground color of the design, then the green will be the figure color; and whenever the green figuring "ply" appears over the red ground "ply," that is ingraining. The more general this ingraining or mixing up of the two webs or "plies," the better the fabric is ingrained, and the longer it will wear. The three-ply ingrain is made and ingrained after the same manner.

A two-ply carpet, woven on the same loom and "mounted" in the same manner as a two-ply ingrain, if woven plain, without any design or pattern, would be a seamless bag; a three-ply, under the same condition, a double bag, or two bags joined together by one side of each.

The old Scotch two-ply ingrain weighed about 24 ounces to the yard. The weft yarns were heavier than those now used, and the warp threads were three-cord worsted, and much stronger and heavier than the two-cord now in general use. Two things are gained by the substitution of the two-cord warp for the three-cord, though the fabric is rendered less durable. One is the saving of worsted, the most expensive of the two materials which compose the fabric; the other is that the warp being finer, it permits a wider scope in shading the weft colors. This will be understood even by the unskilled reader, if he will place an unequal number of coarse and fine black threads on two pieces of scarlet or white cloth or paper of equal width. The finer the black threads are, the brighter the colors underneath will appear.

Ingrain carpets are frequently called Scotch carpets, and by others Kidderminster. The difference in the nomenclature of this fabric, we presume, is due to the fact that, until 1821, Kidderminster had nearly a monopoly in making ingrain. In the memorable strike of that year, which commenced in March and continued into August, it lost nearly all its ingrain trade, which mostly fell into the hands of Scotch manufacturers.—*Textile Manufacturer.*

Glass Circle for the Measurement of Angles.

Mr. Lewis M. Rutherfurd, whose ruled diffraction plates, as substitutes for prisms in certain classes of spectroscopic work, have gained him a very extended reputation, in 1870, proposed a glass scale for the measurement of the angles of astronomical photographs. It was to be read by a micrometer microscope, and fitted with a gravity slide with one V and one flat slide. He has now carried out the idea by constructing a glass circle about 10 inches in diameter, divided to 10 minutes of arc, adapting it to a spectrometer similar to the one used by Mascart, and described in his paper on the measurement of wave lengths. The measurements were read by two microscopes each magnifying 75 diameters. This arrangement is one of the most delicate mechanical refinements that has come under our notice.

New Compensating Pendulum.

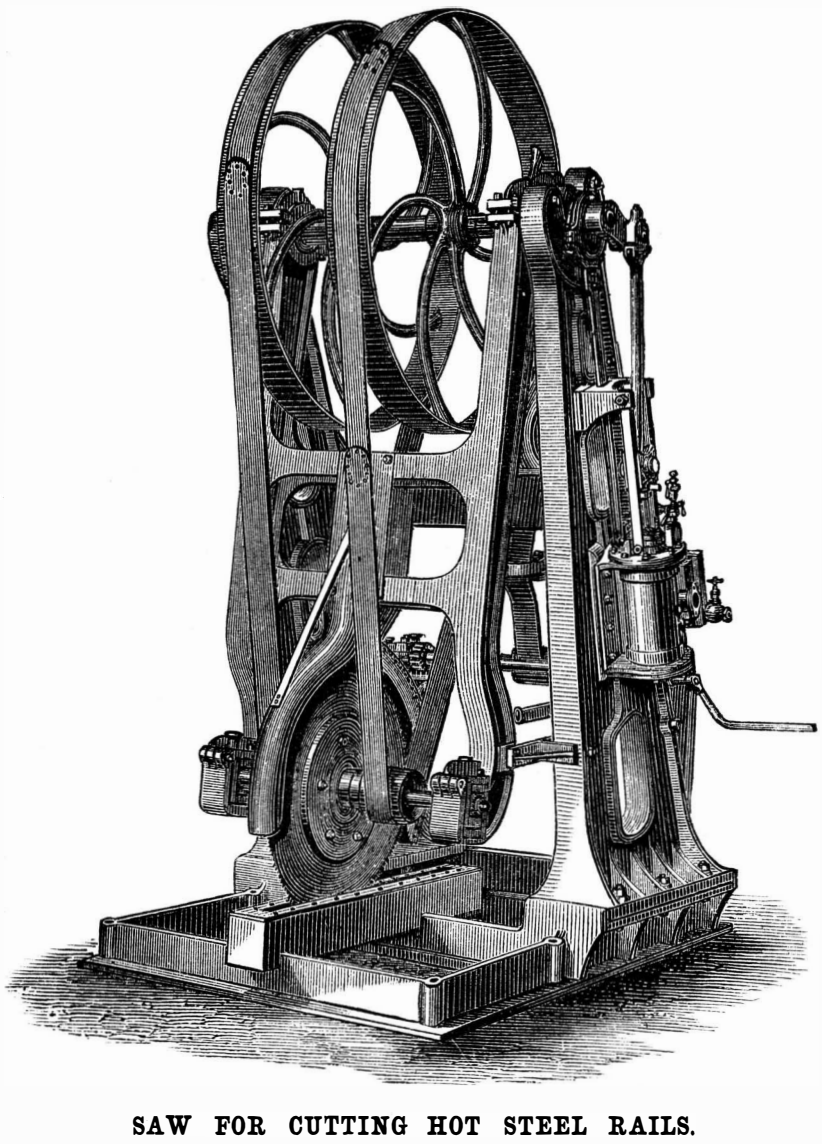
Professor J. Lawrence Smith has recently invented a new compensating pendulum, in which he avails himself of the great expansibility of ebonite, which, between 32° and 158° Fah., approaches that of mercury. The pendulum rod is of steel, with an adjusting screw at the lower end; and a round rod of vulcanite, with a hole in the center, is passed on to the steel rod fitting it loosely and being held in place by the adjusting screw. The bob of the pendulum consists of a heavy piece of brass, with a hole through the center large enough to admit the vulcanite, over which it passes, and, by a properly arranged stop, rests on the end of the vulcanite furthest from the lower end of the pendulum, so that any expansion of the vulcanite elevates the brass bob, thus compensating for the downward expansion of the steel rod and brass bob. Professor Smith says that four months' use of this pendulum on an astronomical clock has given very satisfactory results. It can be adapted, at a cost of 20 cents, to the ordinary mantlepiece clock, the pendulum of which usually beats in half seconds.

MADDER ORANGE.—Madder red, if exposed in a chest to the fumes of nitrous acid No. 3, yields a fine orange, which is not damaged by boiling soap lye. The red may be produced either by dyeing or steaming, and it is indifferent whether the cotton is oiled or not. The action of the fumes is to be continued for five minutes. If it is shorter the orange is converted into a brown by diluted alkalies or by soap.—*Reimann.*

© 1876 SCIENTIFIC AMERICAN, INC.

NEW RAIL SAW AT THE LANDORE STEEL WORKS.

This saw is made by Messrs. Kitson & Co., Airedale Foundery, Leeds, England. Instead of the rail being brought up to the saw, the latter, mountcd in a swing frame which os cillates on the main shaft, advances to the rail. Our engraving is prepared from a photograph of the actual machine, but does not show an ingenious self-acting clutch arrangement, which has since been added, for holding the rail firm while being sawn. The saw is placed sufficiently far from the rolls to admit of a 65 feet length being rolled, to be afterwards cut into rails of the required dimensions. On the occasion of a recent visit, some Great Western Railway bridge rails, 86 lbs. to the yard, were being rolled, and afterwards sawn into two 32 feet lengths. The production of the rail mill at these works is from 600 to 700 tuns a week, the largest output in any one week having been about 850 tuns, though 160 or 170 tuns are frequently got out in the twenty-four hours.—*The Engineer.*



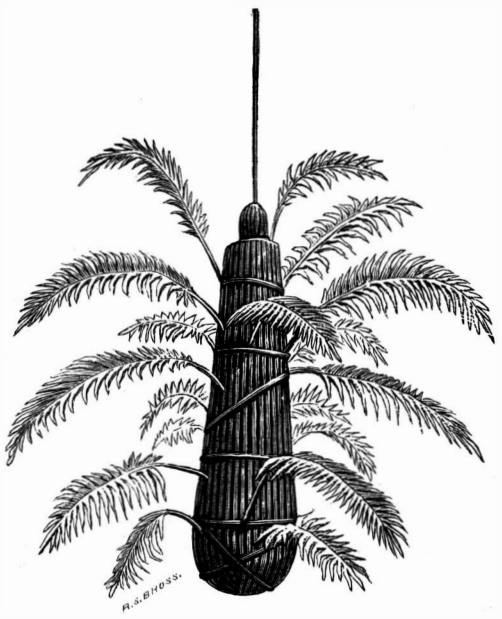
SAW FOR CUTTING HOT STEEL RAILS.

Dental Gardening.

Miss Adelia L., aged 28, nervous temperament, very healthy and robust, consulted me on May 10, 1876, in reference to trouble with left superior second bicuspid. I found, upon examination, a large cavity upon posterior surface, high up under the gum, with exposed pulp and considerable inflammation, attended with severe pain. The cavity being extremely difficult of access, and the patient preferring not to take the chance of possible trouble after a painful operation, I extracted. A moment after, I proposed to her, partly in jest, to fill and replace it. She agreed, and after excavating, etc., I filled the pulp canal with oxychloride and cotton fiber, and the other cavity with amalgam, and then, carefully rinsing the socket first, the tooth was carried up gradually into the alveolus, carrying with it a piece of silk, which was laid longitudinally along the root, in such a manner that, when the tooth was nearly in place, the gradual drawing out of the silk furnished a vent for the escape of air or water confined above the root. Previous to replacing, about one sixteenth inch of the tip of the root was excised, as it was curved considerably. Pain followed for five minutes, after which the lady closed the teeth forcibly, and with a snap, without any feeling of discomfort. She was directed to avoid using it for a day or two, and then report. Ten days after, May 20, she came in and stated that for a couple of days there was some soreness, since which time she had eaten on that side of the mouth without trouble, and at the time of examination the tooth was as firm as the contiguous ones. No ligatures were used to keep it in place at first, as reliance was placed upon the antagonists in the lower jaw.—*W. E. Hyde, Danielsonville, Conn., in Dental Cosmos.*

A JAPANESE FLOWER BASKET.

In the Japanese Building at the Centennial Exposition is to be found a variety of hanging baskets, containing ornamental plants. One of the most graceful designs is shown



in the annexed engraving, the basket being made of the roots of trees, laid parallel and encircled by hoops. Ferns and other plants, judiciously selected, are placed with their roots inside the basket, the flowers and foliage hanging down outside. It would be difficult to imagine a prettier ornament for the parlor or conservatory.

Patents for Seeders and Planters.

Another very useful summary and digest of all patents in a particular class of inventions is announced. It will include the drawings, briefs, and claims of all patents for seeders and planters, from 1836 up to and including July, 1876. The range covered by the class is a very extensive one, including fertilizers, liquid manure machines, land markers, etc. The book will contain from 400 to 600 pages, illustrated by about 3,500 drawings. It will be well bound, and sold for $25 per copy, by the author, Mr. James T. Allen, room 116, Patent Office, Washington, D. C.

New Engraving Process.

Messrs. Leitch & Co., it is said, are now successfully practising a new process, which has not hitherto been carried on here. The drawing is done on glass, covered with a thin etching ground, which is of a pale green color, and so thin that it can be removed with the finest etching point, thus allowing of the most delicate lines being drawn. By placing a sheet of black paper underneath, the artist can perceive at once the progress and effect of his work, the lines of which appear in their natural black. This plate, when finished, is treated as a negative, and a photograph obtained from it, say on zinc, from which a surface block is got in the ordinary way. The great advantage is the possibility of seeing how the work proceeds, for in several processes this cannot be done, and the artist finds, when he has finished his drawing, that it looks very different from what he expected or intended.

The San Fernando Tunnel.

The San Fernando tunnel, through the San Fernando mountains, on the Southern Pacific Railroad, California, is the largest one on the Pacific coast. Its length is 6,966 feet, or 1 mile and 1,686 feet. The work of construction was remarkably rapid; it is not two years since the first borings were made. Many difficulties were encountered. San Fernando is the petroleum region of Los Angeles, and there were fears lest in tunneling the mountain the workmen might come upon reservoirs of petroleum or other noxious fluids and gases. The great obstacle has been the character of the rock, and the enormous pressure upon the timbers placed as supports. The tunnel will be lined with masonry of great strength. The longest tunnel on the Central-Pacific, in crossing the Sierras, is only about 1,200 feet, not one fifth the length of the San Fernando.

Poisoning by Virginian Creeper.

The details of two cases of poisoning by the well known Virginian creeper or American ivy (*ampelopsis hederacea*) have been communicated to the medical papers by Mr. Bernays, of Chatham, England. The sufferers were two children, aged respectively two and a half and five years, who had chewed some leaves of the plant, swallowing only the juice. They were quickly seized with violent vomiting and purging, with considerable tenesmus, then collapse, sweating, and faint pulse, followed by deep sleep for two hours, from which they were aroused by a return of the vomiting and purging. Milk, with some rum mixed in it, was freely administered, under which treatment the children soon recovered; but four hours after the commencement of the attack there was considerable dilation of the pupil.

The pressure in lbs. per square inch produced by centrifugal fans equals the square of the velocity of the tips of the fan in feet per second divided by 97,300.

Hops as a Photo Preservative.

Notwithstanding the great improvements that have been recently made in the various emulsion processes, and the degree of perfection that has been attained in the preparation of the emulsions, many photographers, even amateurs, are conservative enough to stick to their baths, simply because they have long been accustomed to work in that way, and because in the various bath processes there is more latitude in the road leading to success than there is with emulsion work.

It is far from our intention to undervalue the advantages of the several emulsion processes, because they require, for their most successful working, a degree of nicety and care much greater than most of the processes with the bath; but we cannot shut our eyes to the fact that there are many who, from long experience of the older methods of working, get very fine results with it, and who have neither inclination nor time to battle with the difficulties of anything that to them is new. Taking it for granted, then, that for some time at least dry plates will still be sensitized in the bath, we gladly chronicle any advance that may be made or any improvement that may be effected.

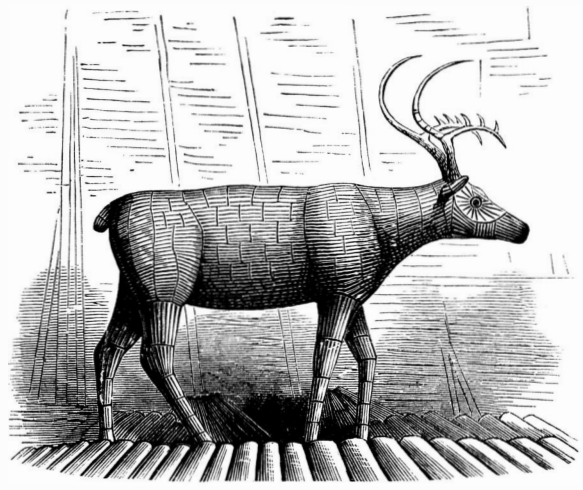
We have recently made numerous experiments, and think the desideratum has been found in ordinary hops—preferably the variety known as Bavarian, which seems stronger in certain qualities than the English hop.

Two ounces of hops are infused for one hour in twenty ounces of water at a temperature of 170° Fah., and the whole then turned into a cloth, and the liquid pressed out. When cold, twenty grains of pyrogallic acid and the albumen of two eggs are added, and the mixture is well shaken for ten minutes. It is then filtered into a dish and used in the ordinary way; or, if only a few plates are to be prepared, a smaller quantity may be made, and poured off and on several times. Plates preserved with this solution, dry perfectly hard, have a fine gloss, and yield negatives of very high quality. The color is a rich greenish brown, and so non-actinic that over-development must be carefully guarded against. Although the solution can be easily made, it is desirable that, if possible, it should be made to deep, and therefore we have added carbolic acid and salicylic acid to separate quantities, and shall note the result on a future occasion.

Meantime we consider the hop preservative as above indicated, a decided improvement on the beer and albumen. It possesses all its good without any of its bad qualities, the principal of which are the sticdiness already referred to, the varying qualities of beer in different local ities, and, especially, the irregular proportions of chlorides which more or less are always present, and to get rid of which many workers are in the habit of adding silver ni trate, which always introduces an additional element of uncertainty.—*British Journal of Photography.*

A SWEDISH CENTENNIAL EXHIBIT.

Our engraving represents a very neatly executed device for exhibiting the various sizes and shapes of nails manufactured by one of the Swedish ironworks. It is the figure of a reindeer, the hide of which is formed of the nails, the forms and dimensions of which are so selected that the *contour* of the animal is unimpaired, the proportions and form being exactly preserved. The figure is to be found in the



Main Building, near the north entrance; and it attracts large numbers of visitors, who cannot but admire the fidelity and ingenuity with which the design is carried out.

New Blue Color.

Girard has taken out an English patent for the following process: He heats 1 part of methyl, ethyl, or amyl diphenylamin with two parts of oxalic acid for 10 to 15 hours to 239° Fah., and washes in water, alcohol, or petroleum. The residual powder is dried and heated for some hours to 230° Fah., which renders it soluble. To prepare methyldiphenylamin 100 parts of diphenylamin, 68 of muriatic acid, and 24 of wood spirit are digested for 15 hours at 536° Fah., at a pressure of 12 atmospheres.

© 1876 SCIENTIFIC AMERICAN, INC.

A MARINE AQUARIUM.

An aquarium, says Mr. R. M. Shurtleff in *Forest and Stream*, from the pages of which we select the engraving, though a very simple matter, was never understood till recently. Persons who keep gold fish in globes find it necessary to change the water frequently, and even then the fish do not remain in a healthy condition. If the tank be properly arranged, the water need never be changed at all. All animals breathe oxygen, and throw off carbon, while plants breathe carbon, and throw of oxygen. If we establish in our aquarium a proper balance of animal and plant life, both will thrive as in their natural homes.

Supposing that our tank has been selected, we should first place in it enough clean pebbles to cover the bottom to a depth of two inches. Above these we may arrange larger rock forms, and if done with taste and judgment it will add much to the beauty of our aquarium, and also furnish hiding places for the fish.

One of the best plants for the salt water aquarium is *ulva litissima*, which may be found in large fronds cast upon the beach after a strong wind has been blowing from the sea. Its color is rich dark green, and when in a healthy condition it is firm and crisp to the touch. Another very handsome plant that thrives well in the aquarium is *catromorpha*. It is found in deep water, and can only be got by dredging. It resembles a mass of fine green threads, which, when untangled, are sometimes found to be thirty feet in length. *Entromorpha compressa* is a beautiful green plant found on nearly every shore at low tide. It grows in long grass-like leaves, that move in most graceful lines with every motion of the water. We have never found it very hardy in the tank. The plants of a brown color, though very beautiful for a time, will soon decay in the aquarium. Some of the red algæ do very well and are a great addition. The *Grinnella Americana* is one of the best. *Chondrus crispus* (Irish moss) will sometimes do well; and *solaria*, if found growing to a bit of stone, will live in confinement, but should not be exposed in much light. There are innumerable beautiful plants to be found at low water mark, that will always tempt us to try, and, if watched closely and removed if found decaying, will do no harm.

Our illustration shows many of the most interesting animals that are adapted to the marine aquarium. In the central part of the picture is a fully expanded sea anemone. Seen in this condition one can readily see why it has received the name of that beautiful flower. At times it appears a mere mass of jelly, and the fishermen along the coast have called it halibut slime, supposing it merely a mass of slime from that fish. The body of the anemone may be described as a double gelatinous sac; the inner sac is the stomach, the space between it and the outer membrane is divided by vertical partitions, each compartment being connected at the upper part with a hollow tentacle. The tentacles serve to catch, and convey to its mouth, such animals as happen within its reach. The anemone is reproduced by eggs that are thrown out in different degrees of development, sometimes as perfectly formed anemones. They also multiply by self-division: a portion of the animal, usually near the base, gradually separates from the main body. If closely observed for a few days a single row of tentacles will make their appearance, and increase in number with the growth. Though a low form of life, the anemones are among the most beautiful and interesting objects in Nature. In color, they vary from a light brown to a deep chocolate. They are found on the coast north of New York, very abundantly in the vicinity of Newport. To the left of them are three of a bright red color that were brought from Bermuda. They differ from the others in having less power of expansion to the body, and have fewer tentacles, but make up for the lack of grace in form by their gorgeous color. The general scientific name for them is *actinia*. Just above is shown a bunch of *serpula contortuplicata*. They belong to the *annelida* or worms proper. They breathe through the skin by sacs or gills. In the present genus the respiration is by gills which are elegant in form and brilliant in color, The body of the serpula is short, the hard tube in which it lives in the sand being many times the length of the animal. Projecting from the tube may be seen a fan-like appendage most beautifully tinted with bands of red and white. This fan is the serpula's gills, and aid it in procuring its food. If viewed with a magnifying glass, it will be seen that the exterior of the gill tufts is covered with wonderfully delicate filaments or cilia which are constantly waving in regular ripples; by this movement a current is produced

A MARINE AQUARIUM.

© 1876 SCIENTIFIC AMERICAN, INC.

that brings in a multitude of minute animals upon which the worm feeds. The serpula is furnished with an arrangement for stopping its tube when it wishes to retire; this is a conical appendage developed from one of the little antennæ, which hangs from the tube and is called the operculum. One specimen in a tank has two kinds of plants growing from its operculum. When first placed in the tank the serpulæ are very sensitive, and pop into their tubes at the least jar. Near the serpula is shown the common shrimp, which is regarded as an excellent scavenger of the tank. The shrimps are so transparent that the food can be seen in the stomach, and we can almost trace the process of digestion.

Attached to the lower part of the rock work are more of the brown, and some of the beautiful little white, anemones. It is almost impossible to describe their form, as they are so changeable. At times hanging from the rock to which they are attached, the tentacles drooping like the petals of a withered flower, again the body stands erect, the tentacles extended to their utmost limit, and in constant motion. Suddenly a part of the body will be contracted as if a string had been drawn tightly around it, and sometimes there will be two or three of these constrictions at the same time. Again, they will assume the form of a rose, and one never tires of watching them. Some days they appear of an opaque white or cream color; an hour later we find them so nearly transparent that the interior divisions of the body can be clearly seen.

At the lower left hand corner is shown a mussel (*modiola plicatula*), and above it the soft clam (*mya arenaria*). The black mussel (*mytilus edulis*) is not shown in the drawing, but is a useful member of the aquarium family, as it lives upon the little animalculæ that sometimes become so plentiful in the tank as to obstruct the view. The star fishes are curious and interesting, but are hardly safe for the aquarium, as they are ravenous eaters, and will probably destroy the shell fish we most wish to preserve. They have a singular way of feeding. Placing themselves upon the animal they wish to devour, the digestive sac is turned inside out so as to enclose their prey, and the animal is sucked from its shell.

The hermit crab (*pagurus longicarpus*) is shown inhabiting the shell of a *tritia trivitata*. These curious little crabs have no armor of their own, and so take possession of any mollusk's shell that happens to fit them—usually one of the *buccinum* family. The rock crab should not be introduced, unless it is a very small specimen, as they over turn the rock work, and are blessed with an appetite that is never satisfied. The spider crab (*labinica canaliculata*) is interesting and less destructive. It loves to dress itself with bits of plant, or anything that comes handy, and then parades with as much evident satisfaction as any dandy.

At the extreme right of the picture is shown a bunch of *tubularia*. This plant-like object is formed of a number of tubes branching in all directions; the end of the tube appears a flower, its petals opening and closing constantly. These heads live a few days, then drop from the stem to be replaced by a new head that may be seen slowly traveling up the tube. The sea horse (*hippocampus Hudsonius*) is another strange little animal that we should possess if possible. Its natural food is the *serpulæ* which it sucks from the tubes, but it will feed upon the soft part of a shrimp or clam. At the top of the illustration is shown a branch *sertularia*. In a picture of this kind only a faint idea can be given, as the beautiful little animals that have formed it are scarcely discernible with the naked eye.

Nearly all the animals we have named can be found on our own coast. Those who prefer to do so can purchase them of dealers. In conclusion we would say that the care of a marine aquarium can be only a source of pleasure to any one who loves Nature. These animals have been drawn from a glass jar holding about twelve quarts of water. For many months it has supported twenty or thirty anemones, besides many other animals, and has always been in a perfectly healthy condition. The only care required was now and then the addition of a little fresh water to replace that evaporated.

A Purple Cyanide as a Dyestuff or Pigment.

When cyanide of potassium is added to an acid solution of a copper salt, a red color is produced which has already been mentioned by different observers. The substance formed is very changeable, at least in the liquid where it is formed. It is decomposed by acids, alkalies, cyanide of potassium, and even decomposed spontaneously, the color changing to yellow. It is precipitated by insoluble cyanides; hence when a dilute acid is added to the red solution, the dye is at once thrown down along with the cyanide of copper. If the precipitate thus obtained is treated with sulphuretted hydrogen, it is decomposed and the substance set free. This substance can combine with iron, like cyanogen, so as to conceal the properties of the iron. This compound is very permanent, and has lately been studied by G. Bong, who gives the following directions for its preparation:

Cyanide of potassium is added in excess to an acid solution of a copper salt until the red color at first formed has disappeared, when a ferric salt is at once added. On the addition of the iron salt, of course, a copious precipitation of Prussian blue takes place, and the liquid again turns to a dark purple-red. To separate the coloring substance from the alkaline salts in the liquid, a dilute acid is added which precipitates it and the cyanide of copper. This precipitate is combined with the Prussian blue, which also contains a considerable quantity of the coloring substance, and then treated with a boiling solution of carbonate of ammonia, in which it dissolves. As the cyanide of copper also goes into solution, it is separated by again precipitating it with an acid and treating the precipitate with sulphuretted hydrogen. The coloring substance thus liberated now contains a certain amount of hydroferrocyanic acid, which is removed after neutralization by acetate of lead. It is now filtered, and the purification completed by precipitating with a silver salt and treating the precipitate with sulphuretted hydrogen.

This purple-colored compound crystallizes very indistinctly. To determine its composition Bong precipitated it with acetate of copper. When dried at 212° Fah., the rose-colored precipitate had the following composition: Carbon 24·31, nitrogen 28·04, hydrogen 1·88, iron 13·66, copper 17·67, oxygen 14·44. Total, 100·00. These numbers correspond to the formula $Cu, Fe Cy_4 (HO)_4$.

This substance is likewise precipitated by salts of zinc, mercury, and silver. All these precipitates are pink or purple, very beautiful, and of remarkable brilliancy. They are soluble in alkalies. Iron salts yield no precipitate, nor do lead salts except in the presence of ammonia, when a blue-violet precipitate is formed. When treated with sulphuretted hydrogen, these precipitates yield purple-red and acid liquids, which undergo change in the air, especially if warm, forming Prussian blue. When these liquids are neutralized with alkali, purple compounds are formed, which are permanent in the air, soluble in water, slightly so in alcohol, and insoluble in ether. Their coloring is exceptionally great. These pigments will unite with ferrocyanides, and in its preparation such a compound is produced in considerable quantity; it is likewise of a purple color, and gives a rose-colored precipitate with acetate of lead. Both alone and in this compound it is very permanent; it resists the action of sulphurous acid, concentrated and boiling alkalies, and dilute acids, but is rapidly destroyed by chlorine and nitric acid. If this pigment could be prepared cheaply enough, it would probably be used with advantage in the arts, on account of its resistance to chemical re-agents and light, the variety of its shades, and its brilliancy. It does not color fibers directly, but can readily be fixed on them from slightly acid solutions, if they are previously mordanted with metallic oxides.

MUSICAL TELEGRAPHY IN PARIS.

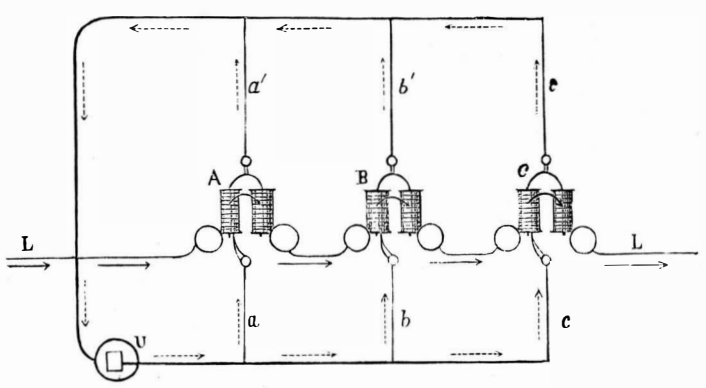
It is now proposed to utilize the La Cour system of musical telegraphy in Paris, in connection with the project of M. Bourbouze of sending telegraphic messages without wires. M. Bourbouze conceived the idea, during the siege of Paris in 1870, that the river Seine might be used as a conductor, so that the beleagured city could hold communication with the provinces without the enemy suspecting the fact. Tests actually proved that the plan was feasible, but before it could be carried into practical effect, the armistice was declared, and so the device became unnecessary. M. Bourbouze has recently again brought forward his idea, and proposes to use the water in the mains and pipes of the city as a conductor. Every one having the necessary simple apparatus could

Fig. 1.

then learn to telegraph for himself. Each house would be a station, and any citizen could converse with friends scattered in all parts of the city without stirring from his own domicile To this somewhat sanguine scheme there is one fatal objection; it is that the result would be a new Babel; for hundreds would telegraph simultaneously, and unless each despatch had some easily distinguishable characteristic, inextricable confusion would follow.

As stated in the beginning, it is suggested that M. La Cour's musical telegraph may furnish a means of transmitting distinguishable despatches. The invention was described recently in the SCIENTIFIC AMERICAN SUPPLEMENT, but the annexed engravings, which we take from *La Nature*, will serve to render its mode of operation more clearly comprehensible.

Fig. 2.



When the most common phenomena of acoustics are recalled, for example, the transmission of a melody played by an orchestra which is perceived by an entire audience at long distances from the players, it is not easy to analyze the effect. Physics tell us that the sounds produced by each instrument have their own tonality and their distinct measure; in other words, the notes from a violin, a flute, or a trombone correspond to different vibrations, transmitted through the atmosphere and characteristic for each note. Besides, the rhythm in the succession of notes, which makes the measure in music, produces the cadence, constituting, with the tonality and the timbre of the instruments, the *ensemble* of the air which affects us. The transmission is so precise that the ear, from the medley of sounds, instantly distinguishes a discordant or untimely note.

Suppose now a series of three tuning forks vibrating continuously and producing, respectively, 100, 300, and 500 vibrations per second. It is easy to perceive that each fork may interrupt and establish an electric current with intermissions regulated by the number of its vibrations. If, then, there be three other forks identical with the first, each set being located at an extremity of the conductor between them, the trio at one end will affect those at the other; and further, if one fork be impressed with a cadence which does not coincide with its regular vibrations, then its corresponding fork will likewise emit the same discordant sounds.

The above very briefly states the principle of the invention, but it is sufficient to show that the indefinite multiplication of despatches over the same conductor is feasible, each current, moreover, being distinctly individualized.

Fig. 1 represents the device for transmitting the vibrations of the fork to the conductor. The arm, *n*, of the fork vibrates in contact with the platinum tongue, *c*, the position of which is regulated by the screw, *v*. A current entering at l^2 is closed, when the extremity, *n*, touches the plate, *c*, and is open when contact is broken. Nothing further is needed than the opposite wire, *l*, connected with the fork as shown.

Fig. 2 shows how the character of an intermittent current is recognized. L L is the main line traversing the station. A B C are three forks similar to those at the point of transmission. The fork, B, for example, which is in unison with the current, will be thrown into vibration while the rest will remain silent. This fork, B, will then touch the platinum plate, *c*, Fig. 1, and will establish in the circuit, $b\ b^1$, a local current of the battery, U, the poles of which are respectively applied at $a\ b\ c$ and $a^1\ b^1\ c^1$. The local current will likewise be intermittent, according to the measure of the fork, but by reason of the velocity of the pulsations it will manifest itself in many cases as a constant current, either by operating a chemical decomposition, or by deviating a magnetized needle, or by exciting an electro-magnet.

The New Hampshire Greenstones.

The greenstone formation of New Hampshire covers a large area in the northern part of the State, and is referred by Professer Hitchcock to the Huronian age; the rocks are generally green, with remarkable uniformity in their composition. Yet they are inter-stratified, apparently not by volcanic eruption, as they appear to have accumulated in quiet waters.

Of the group of greenstones, the most prominent member is metamorphic dioryte, which varies in its texture in different localities, some of the specimens being so coarse as to enable the crystals to be mechanically separated. A hydrous rock, metamorphic diabase, is also very common, in which chlorite is a prominent ingredient, imparting a light green color. In this rock, organic remains, such as a tabulated coral resembling a *chætetes*, are found, and Mr. George W. Hawes states that there is little doubt but that it is a fragment of a rhizopod mass or foraminifer. The presence of rhizopods is additional evidence of the sedimentary origin of these rocks, and it suggests a source for the lime of the labradorite and other mineral constituents. Chlorite schist is also found in these greenstones; it is of a light green color, and gives off water when heated. Twelve per cent of this mineral consists of various oxides of iron. Dolerite and argyllite are also found in the formation, the former containing: Silica 40·25, iron oxides 15·82, lime 10·31, titanic acid 6·53. In the latter, silica 60·49, alumina 19·35, iron oxides 6·46, and magnesia 2·89 were found.

Bat Guano.

That a little creature, not very common in the North, could congregate, in sufficient numbers to make extensive deposits of excrement which have a commercial value, seems almost incredible; but in numerous caves, from Virginia to Texas, are found deposits of this material sometimes reaching 20,000 tuns in extent, and yearly increasing. During the war it was thought to extract niter from it for powder making; but though the manufacture was somewhat successful, the nitric acid was present in such small quantities as to render it so expensive as to be abandoned at the close of the war. The material has been used as a fertilizer to a slight extent, and is found to exert considerable influence on the crops treated. The attention of Mr. McMurtrie, chemist to the Department of Agriculture, having been called to the matter, analyses have been made of samples collected. These are all of a similar light to dark brown color, according to the moisture, except those containing much insoluble matters, which resemble soil, of which they probably largely consist. The physical condition when air-dried is excellent, both for handling and application, being finely pulverulent. The analyses fairly represent the average composition, which, according to the valuations of Professor Goessmann, the Massachusetts State Inspector of Fertilizers, adopted by the department, show them to possess a value of from $15 to $55 per tun for use as fertilizers. The values compare favorably with those of fish fertilizers, and even of Peruvian guano. Microscopical examination shows the material to consist largely of the hard parts of insects upon which the bats feed. Mr

© 1876 SCIENTIFIC AMERICAN, INC.

McMurtrie wisely concludes: "With these facts before us, we may readily recognize the importance of the development of these deposits in the South, where fertilizing materials are so much needed and are so costly, and especially when they may be obtained for the mere cost of removal."

Naval Items.

NAVAL ENGINEER CORPS GAZETTE.

Chief Engineer George Sewell, Wm. G. Buehler, and Ezra J. Whittaker, Passed Assistant Engineers J. P. Kelley, H. L. Slosson, John D. Ford, E. T. Philippi, and Richard Inch, and Assistant Engineers William Rowbotham and George Cowie, have been detached from duty and placed on waiting orders.

August 9. Passed Assistant Engineer John F. Bingham's orders to the Tuscarora, North Pacific Station, have been revoked, and he has been ordered temporarily to the Navy Yard at Mare Island, Cal.

To Remove Nitrate of Silver Stains.

The following method of removing indelible ink and other silver stains, without the use of cyanide of potassium, is given by Grimm in the *Polytechnisches Notizblatt*: Chloride of copper is first applied to the tissue; it is next washed with hyposulphite of soda solution, and afterwards with water. It is said that this may be employed on colored woven cotton tissues. For white cottons and linens, dilute solutions of permanganate of potash and hydrochloric acid, followed by the hyposulphite of soda and clear water, is preferable. For cleaning the hands, we use iodine dissolved either in iodide of potassium or in alcohol, following by aqua ammonia.

Hypochlorite of Alumina in Bleaching.

Dr. E. Jacobsen proposes to use hypochlorite of alumina for purifying bone grease, a gentle heat being employed. This salt is prepared by the mutual decomposition of alum or sulphate of alumina and bleaching powder. A saturated solution is made of the former, and to it is added a corresponding quantity of chloride of lime as a milky liquid. The bleaching is performed, not by the chloride, but by the oxygen liberated as ozone, and the coloring substances are precipitated as lakes by the alumina.

The following is said to be a Texan practice for training sheep dogs: A pup is taken from its mother before its eyes are opened, and put to a ewe to suckle. After a few times, the ewe becomes reconciled to the pup, which follows her like a lamb, grows up among, and remains with the flock, and no wolf, man, or strange dog can come near the sheep; and the dog will bring the flock to the fold regularly at half past seven o'clock, if he is habitually fed at that hour.

NEW BOOKS AND PUBLICATIONS.

THE HOUSEKEEPER'S FRIEND, a Practical Cook Book. Compiled by a Lady of Zanesville, Ohio, and Sold for the Benefit of the Home for the Friendless. Price $1.50. Zanesville, Ohio: Sullivan and Parsons, 87 Main street. New York city: Wiley & Sons, 13 Astor place.

This is a collection of recipes, selected with discretion from a great variety of sources. It is a handy and useful volume, and is sold at a very moderate price; so that purchasers will receive value for their money, and will also aid a charitable institution, the nature of which should enlist the sympathies of all classes and creeds.

THE AMERICAN IRON TRADE IN 1876 POLITICALLY, HISTORICALLY, AND STATISTICALLY CONSIDERED. By James M. Swank, Secretary of the American Iron and Steel Association. Philadelphia, Pa.: The American Iron and Steel Association, 265 South Fourth street.

We took up this book of 200 pages, in the hope of finding some account of improvement in the condition of the prostrate iron industry, some probability of its thousands of toilers receiving fair wages, and some ground for believing that 30 years of political bolstering has not finally extinguished the trade. We find nothing of these things; but instead, there are 114 pages of censure on the government of Great Britain for its conduct (in bygone times) in dealing with its own interests, and also for its illiberal conduct in now admitting American manufactures duty free. We think that our producers who are now seeking a market in England will hardly concur with Mr. Swank and his fellow theorists in believing that every interest is to be sacrificed to the greed of the particular ring which he represents.

STRUBLE'S WEBFOOT MAGAZINE, devoted to Literature, Science and Art, Commerce, etc. Price $2 a year. Portland, Oregon: Wallace R. Struble.

This new comer into the world of periodical literature draws on a variety of authorities for his articles, one of which, "Suspended Animation as a Preserving Agent," is selected from our own pages, no credit being given for the same.

LOUISIANA AS IT IS: its Typography, Resources, etc. By Daniel Dennett. New Orleans, La.: Eureka Press, 33 Natchez street.

A well compiled handbook of the chief features, agricultural, mineral, and climatic, of all parts of the State of Louisiana.

Recent American and Foreign Patents.

NEW HOUSEHOLD INVENTIONS.

IMPROVED DOOR LOCK.

Charles Guild, Piedmont, Wyoming Ter.—This invention is a lock having a series of vertically sliding tumblers with beveled ends, the same being adapted to coincide with a notched rib attached to the bolt. It also relates to the construction of the key with removable interchangeable wards secured by a clamp.

IMPROVED CHAIR.

Aaron Rice, Fitchburg, Mass., assignor to Walter Heywood Chair Company, same place.—The object of this invention is to improve the construction of the backs of chairs, especially those known in the trade as ladies' crown dining chairs and York dining chairs, in such a way as to make them less liable to come apart, and thus stronger and better. It consists in an improved chair, in which the upper ends of the back posts are connected with the ends of the back top with a tongue and groove joint. The construction prevents the back posts and the back top from working loose and coming apart, and thus makes the chairs stronger and more durable, without increasing the cost of manufacture.

HOSE ATTACHMENT TO WASH BASIN CONNECTIONS.

Daniel G. Trembley, Brooklyn, N. Y.—The object of this invention is to provide a simple means for attaching fire hose to the wash-stand pipe or faucet, so that, in case fire breaks out in a room having water from the street main, water can be quickly applied for stopping it. The connection is perfectly made with the faucet, but it may be made with the pipe below the basin. By this attachment, fires may often be prevented which would otherwise get too strong to be extinguished by the ordinary appliances before they can be brought to bear. The hose connection may be connected to the pipe below the basin.

IMPROVED FOLDING CHAIR.

George W. Parker, Gardner, Mass.—The object of this invention is to furnish an improved chair, so constructed that it may be easily folded into a compact form for storage or transportation, and which, when opened out for use, shall be strong and firm. With this construction, in folding the chair, the arms and the seat are turned up. The front posts and the rockers are then turned up forward into position, and the chair is folded. The chair is unfolded by reversing this operation.

IMPROVED PETROLEUM COOKING STOVE.

Frederick Hildebrandt, New York city.—This is a petroleum cooking stove that rests directly on the lamp, and produces the complete consumption of the gases of combustion of the flame, by an increased supply of air, preventing the smelling of the stove, and furnishes an economical cooking stove. It consists of a perforated sheet metal body resting directly on the lamp, and supporting an interior chimney that is connected at the top by an inverted conical diaphragm with the body, and provided at the base with a burner-encircling cone inside of the chimney to conduct the air both at the inside and outside of the cone to the flame of the burner. The combustion takes place within the chimney and above the base cone, so as to draw the heat upward away from burner and lamp, keeping the body of the stove cool, and admitting the direct position of the stove over the lamp without requiring an insulating air space or cooling water chambers.

IMPROVED LOCK FOR DOORS.

Theodore Hendricks, New York city, assignor to himself and William E. Price, Brooklyn, N. Y.—This invention consists in providing the split or double spring of a tubular lock with hook ends that differ in length, to be applied in connection with the catch plate. The split spring is attached to the side of the bolt by a stud, and is raised by the key without raising the bolt to engage and disengage the hooks with the catch slots for fastening the bolt. This spring is made in two parts, one of which has a longer hook or catch than the other, to be raised by a bit, and there is a stud on the bolt to prevent it from being raised by a key not having the ward. Shoulders in the side of the bolt constitute forward and backward stops, and act against a stud which bears against the side of the bolt to keep it in its place.

IMPROVED WASHBOARD.

Westly Todd, Wauseon, Ohio, assignor to himself and H. H. Williams, same place.—This invention furnishes a washboard which shall be so constructed that the gritty water from the soiled clothes may run off at once, which will facilitate the washing, and will produce a stronger and more durable board than those constructed in the usual way. This washboard has on its back a zinc facing, provided with parallel corrugations, beginning at each side and meeting at an angle in the middle, a groove being arranged at said angle.

IMPROVED FIREPLACE.

Molesworth B. King, Chicago, Ill.—This is an air-heating contrivance with a fire grate for heating upper rooms; and consists of a fire grate, below which is an ash sifter over the ash pit, for sifting the cinders from the ashes as they fall into the pit, and having a rod extending out at the front or side of one of the joints for working it. There is a blower, in which a damper admits air to prevent the blaze from striking the enameled front of the fireplace, and for admitting a regulated supply of air over the fire bed. A pipe admits fresh air from outside to the space under the fire grate, for supplying air for combustion. The inventor also proposes to make a hollow handle to the blower, with perforations, to allow the air to circulate through it and keep it cool.

IMPROVED IRONING APPARATUS.

Daniel Bennett, Chillicothe, Ohio.—This invention consists of a reciporating iron, with contrivance for heating it by steam, which is admitted to and exhausted from it, while running, by pipes having an extension joint, with stuffing box working correspondingly with the iron; and also of a work table having vertical and lateral reciprocating movements, in combination with the reciprocating iron, to present the work to the iron. The work table is mounted on a support, which is adjustable laterally in the support by a lever, to allow the goods to be shifted along the iron as the work progresses; and it is mounted thereon by springs which yield to the inequalities of the goods, and press them up to the iron by an elastic pressure calculated to enable the iron to work easily and pass the goods uniformly.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WEATHER BOARDING.

Thomas Reynolds, East New York, N. Y., assignor to himself and Jacob W. Erreger, of the same place.—This invention consists of the siding, roof boarding, and other outside clapboarding of buildings, tongued and grooved in the lap to make tighter and more efficient joints, for preventing the air from blowing in and out, and also to prevent dampness from working through. Siding has been rabbet jointed, but such joints, this inventor claims, are not sufficiently effectual for excluding damp air and strong winds; and he proposes to employ this method in roof boarding as well as siding.

IMPROVED SCROLL SAW.

Peter G. Giroud, Brooklyn, N. Y., assignor to himself and Theodore L. Jabine, of same place.—The object of this invention is to provide an improved scroll saw for sawing the minutest work in wood, iron, and other materials, by providing a steady tension that keeps the saw blade at an even strain during its whole stroke, without interfering in the least with the driving power. This is effected by a saw blade, clamped securely in such manner that it may be put in or removed with great facility. The back of the saw blade is steadied along the table to work with great accuracy.

IMPROVED SAW-FILING MACHINE.

Gershom Wiborn, Manistee, Mich.—This invention consists of a head in which a frame is supported, in which the reciprocating file-carrying rod works, the said head being a solid block, with a bifurcated extension of one side forming a couple of legs, which straddle the saw, and fasten the head to it by set screws, and one leg carries an adjustable rod, which holds a gage, by which the position of the head is gaged from the collar of the saw arbor. The pivot connection of the reciprocating rod-holding frame is adjustable in the head, to regulate the inclination of the file to bevel the top of the tooth, and said frame is adjustable, to adjust the file for the bevel of the front of the tooth, so that the file may be fixed for making both of these angles without changing either of its inclinations.

IMPROVED MACHINE FOR DRESSING STAVES.

Adam Luckhaupt, Columbus, O.—This invention relates to a machine for manufacturing staves for beer kegs and barrels of all kinds, in such a manner that the wood is cut transversely to the grain, and not in the direction of the same, the wood being readily and without danger inserted into the machine, and quickly cut to the shape required. It consists of two series of cutters that are secured to shafts revolving in opposite directions, and adjusted at such distance as to cut the shape of the stave. The stave is secured to the clamps, prongs, or jaws of a weighted and swinging frame that runs in arc-shaped guides, being locked in vertical position, in connection with a sliding table or guard plate, and fed to the knives by releasing the locking device, and swinging the frame into horizontal position to expose the wood to the action of the knives. The finished stave is then released from the clamps and dropped, the frame being carried back to take up the next piece of wood.

NEW AGRICULTURAL INVENTIONS.

IMPROVED ANIMAL MUZZLES.

Rufus K. Blodgett, Morrison, Ill., assignor to himself and Henry M. Myers, of tame place.—The first of these two inventions is an improved muzzle for calves and other animals, to prevent them from sucking other animals or themselves. It consists in the combination, with each other, of a part provided with a knobbed arm, and having a short perforated tenon upon its outer end, and a long tenon with two or more holes upon its inner end, the part provided with a knobbed arm, and having a hole or socket through its base, the open rings or links, and the plate having its upper edge turned over. The second invention furnishes a device for preventing calves from sucking cows, and for preventing cows and other stock from sucking themselves or each other. It consists of a muzzle formed of a suspended plate, hinged loops and a wire spring clamp. With this construction the muzzle will prevent the animal to which it may be applied from sucking itself or another, will allow the animal to eat and drink freely, and may be worn without pain or inconvenience.

IMPROVED CULTIVATOR PLOW AND HARROW.

Jacob Haynes, Basnettsville, W. Va.—The object of this invention is to furnish a machine for loosening up the soil and cultivating corn and other crops planted in hills and drills, and which shall be simple in construction and easily guided and controlled. The machine seems to be well adapted to the purposes for which it is designed, but it is too compiicated to admit of description without engravings.

IMPROVED SEED PLANTER.

Henry O'Neal, Concord, Tenn.—The object of this invention is to furnish a planter, for planting cotton, corn, peas, and other seeds, so constructed as to enable the planting to be done in perfect check row, without previously marking the land. The machine which appears to be well adapted to the purpose for which it is intended, is too complicated for explanation without engravings.

IMPROVED STACK COVER.

George E. Tuck, Herbert Dorn, and James Steinson, Ridgway, Ia.—This invention consists in a conical stack cover, provided with a lifting ring at its apex. A cap of canvas or other approved material is constructed in conical form, and having a rope or cord around the base, with rings on it for hitching on the stay ropes to keep the cap in place, and stay the stack against the wind. The cap may be made of waterproof material; but probably ordinary canvas, with a coating of waterproof paint, will generally be used. A ring or loop is placed at the apex of the conical cap, so that the latter may be conveniently lifted with a rod or pole having a fork at one end, and then dropped over the grain or hay without the trouble of climbing, by ladder or otherwise, upon the stack.

IMPROVED PLOW FOR LAYING OFF LAND FOR TOBACCO.

John Preston and Charles W. Tennis, Millford, Ky.—This invention is an improved plow for laying off land and making the hills for tobacco, cabbages, and other plants cultivated by transplanting, so constructed as to open a furrow, roll the land, and mark the places for the hills. It consists in a wheel having diamond-shaped blocks attached to its face, in combination with a beam or frame and the plow, and in combination with guide arms, sliding band, and adjusting lever, the beam or the frame, and the plow.

IMPROVED PLOW.

Jacob Heckendorn, Ann Arbor, Mich.—In this plow, a skiver, jointer, or colter, is connected with the plow in such a way that its position will not be changed by the lateral adjustment of the beam, that it will leave space for the ready escape of rubbish, that it may be adjusted to work deeper or shallower in the ground, and will throw the rubbish into such a position that it will be covered by the furrow slice. With this construction, a skiver cuts a smooth, clean groove or channel, and throws the soil and rubbish in front of the turning furrow slice, so that it will be covered by said slice; and the plow beam may be adjusted without affecting the position of the skiver, and a large space will be left beneath to allow rubbish to pass off freely.

IMPROVED ANIMAL TRAP.

John H. Morris, Seward, Neb.—This invention is an improved trap for catching animals, for the entrance of stock yards, for the chutes through which cattle are loaded upon cars, and for other similar uses, which shall be so constructed as to remain open except when an animal may attempt to go out, and which will again open as soon as he desists from his attempt. It consists in the combination of the hinged gate and the tilting platform, with the end or ends of a passage, and in the combination of the second passage, the box, and the drop gate with the main passage, provided at one or both ends with a hinged gate and a tilting platform.

IMPROVED RIDING HARROW.

Isaac N. Harris and William H. Bowne, Pavilion, Ill.—This invention is an improved riding harrow, simple in construction, effective in operation, convenient in use, easily guided and controlled, and of light draft. The wheels revolve upon the journals of the axle. The axle is made long, so that the harrow frame may be received between the wheels. To the middle part of the axle is attached a frame which consists of two side bars, connected at their ends by two end bars. The tongue, to which the draft is applied, by which the harrow is guided, is attached to the axle and to the front cross bar of the frame. The harrow frame is made in two parts, halves or sections, each section consisting of six, more or less, parallel cross bars, to which the teeth are attached, and to which, near the ends of their upper sides, are attached two longitudinal bars. To the forward end of the longitudinal bars of each part of the frame are attached the lower ends of two chains which cross each other, and are hooked upon hooks attached to the middle and outer parts of the long cross bar attached to the front bar of the frame, consisting of the side bars. To the rear ends of the longitudinal bars of each part of the frame are attached the lower ends of two chains, the upper ends of which are attached to the middle and outer parts of the axle. By this arrangement of the draft chains the parts of the harrow frame are free to adjust themselves to the surface of the ground, however uneven it may be, and at the same time will be kept in their proper relative positions.

© 1876 SCIENTIFIC AMERICAN, INC.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED KEY BOARD FOR TYPE WRITER.

Philander Deming, Albany, N. Y.—The object of this invention is to improve writing machines where a stenotypic key is employed; and it consists in using a divisor bar with key board, so as to permit the instant working of the key from any part of the board, the said bar being weighted and pivoted or spring-carried, so as to rise and fall like a key, and arranged diagonally, midway, around, or otherwise with respect to the keys. It is also to be connected with the stenotypic key, either permanently or by a swing button.

IMPROVED APPARATUS FOR LOADING WAGONS.

Anderson Taylor, Fairville, Mo.—This invention relates to that class of elevators which are used to raise heavy articles for loading wagons; and it consists in a lever supported on suitable frame work, to the shorter end of which a platform is suspended, and the longer end engages with a ratchet, the whole so arranged that a heavy article placed on the platform may be raised to the required hight, when it will be retained by the ratchet.

IMPROVED GRATE FOR BRICK KILN.

Alfred Hall, Perth Amboy, N. J.—This invention consists in a hinged front section of a grate, which takes the place of the ordinary dead plate and door, so arranged as to be capable of being lowered into a horizontal position when the kiln is charged, but may be readily raised into an inclined position, so as to partially close the mouth of the kiln. The advantage claimed for the invention is that the fire may be readily cleaned without lowering the grate, thus avoiding the admission of a volume of cold air, also obviating the exposure of the fireman to the intense heat—a thing which is inevitable when doors are used. Another advantage is that the quantity of air admitted to the kiln through and above the grate is such as to permit the kiln to burn evenly from front to rear, effecting a saving in time and fuel, and producing brick of a uniform color and quality.

IMPROVED LOCKWORK ATTACHMENT FOR CLOCK.

John W. Williams, New York city.—The object of this invention is to improve the construction of the works of striking clocks in such a way that the hands may be turned back to set the clock without injuring the works. It consists in the stop pin, attached to the frame, in combination with the lever and the cam that trip the striking mechanism. To the frame is attached a stop pin for the lever to rest against to prevent its forward end from being pressed inward toward a post when a cam is passing over it, and which would prevent it from being again operated to release the striking mechanism.

IMPROVED CRATE FOR SEWING MACHINE.

Andrew J. Callahan, Palmyra, Ill.—This invention consists of a cage or crate for sewing machines and the like, constructed to be taken apart and packed in compact form for return, and having braces and binding screws to maintain it in the shape for containing the machine.

IMPROVED CAR COUPLING.

William L. Nuckols, Millville, Mo.—This coupling is an improvement in the class known as automatic; and the feature of novelty is the means for holding the link at various angles, to adapt it to enter the drawheads of other cars of the same or different hight, and engage with a pivoted coupling pin or other equivalent device, and thus couple two cars together. The bumper heads have long tapering cavities, and a double incline is formed on or attached to the floor thereof. The L-shaped coupling pin has trunnions and is held in place by dogs. When in the vertical position, the pin abuts the end walls of the slots in the top portion and floor of the drawheads, and is thus enabled to withstand the strain to which it is necessarily subjected by applied traction. In the rear corner of the coupling pin is formed a notch, for convenience in raising it in uncoupling the cars; or a ring may be attached to it, to receive a chain or rod for uncoupling.

IMPROVED MOTIVE POWER.

Adam Graner, New Orleans, La.—This invention consists in combining a drive shaft, counter shaft, and saw shaft, the latter provided with a roll arranged thereunder. The crank for turning the driving shaft by hand has a handle, to which is attached a connecting rod which, at the lower end, connects with a foot treadle, so that the operator may work with both. It is also proposed to apply these drivers to both ends of the driving shaft in practice.

IMPROVED FEED WATER HEATER AND FILTER.

Samuel A. Shoaff, Pennville, Ind.—This invention relates to a feed water heater and filter, in which the water is first thoroughly heated up by steam while passing in a tortuous course through the heater, so as to deposit the lime and then convey the water to the filtering receptacle below, where the water is conducted through the compartments without being agitated by the steam. It consists of a feed water heater arranged above a filter, the heater being made of inclined sections, with lateral steam tubes or passages that extend alternately from one side to some distance of the other side, to conduct the water around the same. The water is conveyed through a connecting pipe to the filter, that is provided with entrance and exit chambers and filtering compartments, separated by vertical partitions having alternate openings at the top or bottom.

IMPROVED CAR AXLE BOX.

George W. Miltimore, Janesville, Wis.—This invention relates to improvements in that class of car axles in which a stationary inner and a revolutionary outer wheel, carrying axle or sleeve, are employed, so that the lubrication of the journal box from the oil reservoir is accomplished, to the exclusion of dust, the drip oil collected, and the journal box allowed to oscillate on the stationary axle to conform itself to a true bearing throughout, according to the spring of the axle produced by the weight of the car. The lubrication of the car axle is accomplished in an economical manner, and the wearing out of the journal box is diminished by distributing the friction throughout the length and circumference of the box, in consequence of the oscillating motion of the journal boxes.

IMPROVED RAILWAY SIGNAL.

James E. McCarty, Cold Spring, N. Y.—This invention is an improved signaling device for railroad tracks, by which the track tender or the automatic action of the train can readily set a torpedo signal to warn the trains in either direction of the danger ahead, and make them proceed cautiously, or stop until the cause of danger is ascertained and removed. It consists of a torpedo-setting and signaling device that is operated by wire connection with suitable ratchet and pawl devices at some distance from the danger signal, or at intermediate points, or by suitable mechanism worked by the train itself.

IMPROVED FANNING MILL.

Charles Saunders, Cape Vincent, N. Y.—The chief features of this invention are an improved feed apparatus, and arrangement of chaffing, screening, and separating shoes independently of each other, for regulating each according to its needs, and for working them so as to counteract the shocks of one by the other; and also of adjusting contrivances for regulating the inclination of the screens.

IMPROVED COMBINED LIQUID PUMP AND FUNNEL.

Henry A. Guignon, Corry, Pa.—This invention is an improved pump and funnel, by which the liquids may readily be drawn out of the barrel and the waste liquid returned back to the same; and it consists of a pump passing through a bung into the barrel, the bung being recessed and connected by a pipe with a funnel and grate for conveying the waste liquid back into the barrel. The pump may be readily detached from the bung, when desired to be used without the funnel, for pumping the contents of one barrel into another, and for other purposes.

IMPROVED COMPOSITION RUBBER FOR MILLSTONES.

John H. Miller, Mount Union, Pa.—This improved burr millstone rubber consists of soft fire clay, about 9 parts; silver sand, 1 part; and ground emery, 4-100 parts, prepared as follows: The fire clay is first ground; the silver sand and emery are then added, and a sufficient quantity of water to mix and prepare the mass for molding; it is molded into the form required, and dried and baked. The object is to make a rubber for smoothing and truing the face and working out the furrows of millstones that will be more efficient and less liable to glaze than the burr rubbers commonly used.

IMPROVED GAS REGULATOR.

Charles C. Place, Somerville, Mass.—This invention is intended to furnish an improved device for attachment to a gas pipe to check the pressure of the gas and purify it before it is allowed to pass to the burners. It consists in the combination of a T pipe, provided with the cap and the filtering box, with the lower part of a gas regulator for purifying the gas introduced into said regulator, and in the gas regulator formed by the combination with each other of the lower part, provided with the shoulder, the middle part provided with the V-shaped ring flange to receive quicksilver, the cap, the lower plate, the weighted plate, and the valve and its adjusting rod.

IMPROVED CAR REPLACER.

Henry C. Hosier and John L. Watkins, Sugar Notch, Pa.—The object of this invention is to replace engines, box cars, freight cars, etc., upon a track in cases of wreck and other accidents. A bar has the forward part made with a base something like the base of an ordinary rail, and the rear part is made without a base, so that it may lie close to the rail, and with its rear end overlapping the said rail. A hook clamp is so formed as to hook over the head of a rail, and have one end or arm rest upon the base of said rail. The clamp is swiveled to the end of the bar so that it may be turned to adapt the bar to be placed upon the outer side of either rail of the track. The bar is made about ten feet long, and is inclined or beveled off, to enable the wheels to pass upon it readily. The rear part of the bar is connected with the rail by rods, the inner ends of which have hooks formed upon them, to hook upon the head of the rail. The outer ends of the rods pass through holes in the bar, and have holes formed through them to receive keys by which the said bar is secured in place upon the said rods. Another bar is placed between the rails of the track. This bar is made about six feet long, has its forward end beveled off or inclined, and is connected with the rail by hook rods and keys. When the engine or car is entirely off the track, a latch or false frog is used. The latch is an iron bar of suitable length and strength, the ends of which are beveled off upon their upper sides, and have U clamps attached to their lower sides. The latch is placed upon the rail diagonally. The U clamp of the outer end of the latch is hooked upon the end of a piece of rail in the same way. In this case, the first mentioned bar should be lengthened by another piece of rail. It is not possible to give a clear idea of the operation of this device without engravings.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED COAL BASKET.

Charles Hager, Watertown, assignor to Albert H. Bullard, Lewis, N. Y.—This invention consists in constructing a portion of each end of a coal basket of sheet metal, and in the substitution thereof for a portion of the splints of which these baskets are now made, the object being to make those parts which are subject to most wear and are exposed to the fire, and thus liable to burn out when the baskets are used for feeding furnaces, more durable, and it also makes them freer to discharge the coal, as it slides off the metal easier than from the wooden splints. The common baskets give out in the splint parts by wear, or by burning out when the baskets are used for feeding fires, while the other parts are still good, making a considerable amount of waste, which is avoided by this improvement, which makes the baskets as durable in that part as in any other.

IMPROVED MUCILAGE HOLDER.

Joseph Vincent Browne, New York city, assignor to himself and George W. Ross, Magog, Canada.—This is a mucilage bottle having a sponge on the top of the cork, and a hole through the cork for supplying the sponge with mucilage, to use the sponge for applying it; and it consists of a cap for the cork and sponge, having a vent in the top to be used for forcing the mucilage into the sponge when a large supply is wanted, by closing the vent by the finger placed over it, or other means, and compressing air in the bottle by quickly putting on the cap, and then opening the vent to let the air escape, when it forces some of the mucilage along with it into the sponge. The cork has a shoulder fitting on the top of the bottle, to prevent it from being pressed into the bottle too far, and to facilitate the removal of it for refilling the bottle. The bottle is designed to lay on the side to prevent the mucilage from draining back into the bottle, and it has a round bottom to prevent it from sitting upright.

IMPROVED LUBRICATING COMPOUND.

Jasper G. Upper, St. Thomas, Canada.—The object of this invention is to furnish an improved lubricator for the journals of cars, steamboats, and machinery, to keep them from heating and to cool them when hot. It consists in the lubricator, formed of tallow, rosin, salt, sulphur, and plumbago, in certain proportions and combined in a certain manner.

IMPROVED HALTER.

John Cronin, Boston, Mass.—This is a contrivance for making a halter for horses more simple and adjustable, and without so many rings, loops, and buckles, etc., as common halters have. The invention consists of check straps, arranged in a ring, forming a loop for the nose, instead of connecting with a ring at each cheek, to which the nose piece also connects, making the halter much cheaper, and so that, by taking up or letting out the straps, they and the nose piece will be adjusted alike for large or small horses.

IMPROVED DESSERT COMPOSITION.

Leopold Schepp, New York city.—The object of this invention is to prepare an article of food from cocoa nuts, to be used as a dessert. It relates more specially to such a composition for cocoa-nut drops, by which they will preserve the flavor and richness of the nut for an indefinite time without being liable to become rancid and stale, as do the present cocoa nut preparations. It consists of a mixture of purified or desiccated cocoa nut and cocoa nut oil, with the substances commonly used in the manufacture of cocoa nut articles.

IMPROVED METHOD OF FILLING TEETH.

Romalders Noble, Brunswick, Ga.—This invention consists of capping a filling of amalgam, or other material which is soft when put in the cavity and hardens readily, by a cap of fine rolled gold, having notched or dental or headed pins, or other anchorages, which is pressed into the filling while in a soft state, so as to be secured when the filling hardens, and thus securely hold the cap.

IMPROVED SLEEVE BUTTON.

Thomas W. F. Smitten, Brooklyn, N. Y.—This invention consists in bending the shank of a disk sleeve button to one side, and joining to the end thereof a latch provided with a toe extending rearwardly beyond its pivot. The pivoted latch has a short arm beyond the pivot, to act as a toe on the cuff to prevent it from swinging open, said protection being sufficiently short to allow the latch to swing open by a little pressure when the button is to be taken out.

IMPROVED FRUIT DRYER.

Samuel W. Hope, Dover, Del.—This invention relates to a drying chamber having two compartments, each provided with an elevator or hoisting apparatus, and communicating, by means of an opening in the partition, through which trays of fruit may be slid from one elevator on to the other, and thus passed from the first compartment, in which the moisture is mainly eliminated from the fruit, to the second compartment, where the drying process is perfected. The invention further relates to the construction of the elevators in detachable sections. The trays of fruit are first placed in the left hand compartment, and when the moisture has been mainly eliminated they are slid into the second or right hand compartment, where the drying process is carried to completion, in an atmosphere containing far less moisture than the first.

IMPROVED SHOE.

Martin R. Bodkin, Jersey City, N. J.—Heretofore the practice has been to provide such shoes with a single row of buttons and a single folding flap, having a corresponding number of buttonholes, or with two rows of buttons and two folding flaps. In both cases, however, the edge of the flaps is subject to rapid wear by reason of friction with the bottom of the pants, and is also liable to be torn in the operation of buttoning, and to be otherwise abraded or injured. According to this invention, a single row of buttons is attached to the tongue or center piece of the shoe, and each of the two flaps is provided with buttonholes, and likewise so formed and attached to the shoe as to adapt it to be buttoned under or over the other flap. Hence, when the edge of one flap is worn, abraded, or otherwise injured, it may be buttoned under the other flap, which, not having been subject to wear, is fresh and new in appearance.

IMPROVED HARNESS PAD.

Mirom V. Lomgsworth, Delphos, O.—The object of this invention is to save labor and lessen the cost in making harness pads, while, at the same time, producing neat, strong, and durable pads. The upper side of the pad is covered with a leather plate. Two metal plates are interposed between the saddle strap and the leather plate, and extend from the lower end of said plate, or from near said lower end, nearly to the water hook. The side edges of the plates may be bent upward at the side edges of the strap to keep the said strap from being drawn out of place. To the lower ends of the plates are attached, or upon them are formed, loops or rings to which are attached the straps to which the belly band straps and the straps that support the traces are connected, so that the movements of the traces cannot cause the pad to work upon and chafe the horse's back.

IMPROVED FAUCET.

Hilar Ohnmacht and Robert Weiss, New Orleans, La.—This is an improved faucet for beer and other barrels, by which they may be tapped with great facility without loss of liquid, and by which the driving in of the faucets and consequent damage to the barrel heads, and the use of the casks, will be dispensed with. It consists of a solid plug screwed into the bushing of the faucet hole, and provided with a smaller turning plug, having a curved exit channel that communicates with a similar channel of the cylindrical plug, so as to connect and disconnect the channels, and thereby close or open the faucet.

IMPROVED HAWSER CLAMP.

William H. McGill and Frederick Bowen, Angelica, Pa.—This invention relates to an improved rope socket of strong and substantial construction, and consists of wedge-shaped clamp pieces binding on the rope, and of wedge keys and pins that lock the clamp pieces in the socket. The clamp pieces are firmly locked by the wedge keys, firmly driven in between the socket and clamp pieces, and fastened by lateral pins passed through guide holes of the sockets. The rope is thus rigidly fastened to the socket without danger of getting detached therefrom.

IMPROVED CARTRIDGE-LOADING IMPLEMENT.

William W. Arnold, Rushville, Ind.—This invention relates to that class of instruments which are used in loading and capping metallic cartridges, and it consists of a lever combined with other devices, making a convenient instrument for loading and capping metallic cartridges, and for removing cartridges from the gun; also, for removing the spent cap from the cartridge. The manner of using the instrument is as follows: In filling cartridges, the head is used to force the powder and wads home. Caps are placed on the cartridge by placing the cartridge shell in a ring, putting the cap on the anvil of the cartridge, and forcing it down with the lever. After a cartridge has been discharged, it may be removed from the gun by placing the hooks on the flange at the end of the shell, and drawing it out by the ring or lever. The spent cap is removed from the cartridge shell by forcing the pin against it from the inside of the shell, the head serving as a guide, insuring its entrance at the cap aperture.

NEW TEXTILE MACHINERY.

IMPROVED PAPER COP TUBES.

John McCausland, Providence, R I.—This invention consists as a new article of manufacture in the particular construction of a paper cop tube, made in the form of a cylinder of uniform diameter, and having a bushing of wood located in the upper end, directly at the edges and flush with the same.

IMPROVED CARDING MACHINE.

James C. Ryan, Amesbury, Mass.—This invention consists of an attachment to carding machines, for making nubbed and clouded or imitation printed yarn, the same being intermittent feed rollers, a knife for holding back the yarn or sliver, and a wipe roll, by which the yarn is supplied to the doffer of the carding machine, and there combined with the stock, forming the groundwork of the yarn. This machine will make nubbed yarn with the webs any distance apart, provided it be geared so that the speed may be varied, the sliver being fed in full size when the knife is raised, and checked back and stretched when the knife is closed on the feed roller. It will also make clouded or imitation printed yarn of different colors, as many different colors as may be desired being employed, and being separated from each other by passing through different guide eyes. For making clouded yarn, the knife will be taken out when the attachment is not wanted.

© 1876 SCIENTIFIC AMERICAN, INC.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line for each insertion. If the Notice exceeds Four Lines, One Dollar and a Half per Line will be charged.

Agricultural Implements and Industrial Machinery for Export and Domestic Use. R.H.Allen & Co., N.Y.

Walrus Leather, Walrus Wheels, and Polishing Material. Greene, Tweed & Co., 18 Park Place, N. Y.

Blake's Belt Studs, Belting, Packing, Hose and Manufacturers' Supplies generally. Greene, Tweed & Co., 18 Park Place, New York.

Want to Sell Letters Patent for Rubber Shoe Heel Supporter, or take royalty. Martin Bock, Berwick, Pa.

For 2d Hand Portable and Stationary Boilers and Engines, address Junius Harris, Titusville, Pa.

Models for Inventors. H. B. Morris, Ithaca, N.Y.

Wanted to Buy Patents of Saleable Articles in Iron or Brass. Address, with particulars, "Star," 245 North 8th St., Philadelphia, Pa.

Jethro Wood.—If any of our readers can send or refer us to any publication containing a portrait of Jethro Wood, the plow inventor, we should be obliged. Munn & Co.

Yacht and Stationary Engines, sizes 2, 4, 6 and 8 H. P. Best for price. N. W. Twiss, New Haven, Conn.

Removal — Shearman's Machinery Depot has been removed from 45 Courtlandt to 46 Courtlandt St., New York, where we will be pleased to see our former patrons.

Screw-Cutting Foot Lathes. W.E.Lewis, Cl'v'd, O.

For the cheapest and best Small Portable Engine manufactured, address Peter Walrath, Chittenango, N.Y

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct.

Patent Scroll and Band Saws, best and cheapest in use. Cordesman, Egan & Co., Cincinnati, Ohio.

M. Shaw, Manufacturer of Insulated Wire for galvanic and telegraph purposes, &c., 259 W. 27th St., N.Y.

For Sale, together or separately—Two 11 in. hydraulic Presses; Tubular Boiler, new, built by Fletcher & Harrison; Steam Engine, 25 h.p., built by Woodruff & Beach; three sets Hydraulic Pumps. Robert Dillon, 30 Burling Slip, New-York.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 520 Water Street, New York.

Pat'd Graining Stencils—J. J. Callow, Clevel'd, O.

Lathe Dogs, Expanding Mandrels, Steel Clamps, &c., for Machinists. Manufactured by C. W. LeCount, So. Norwalk, Ct. Send for reduced Price List.

Dynamo-Electric Machines for electro-plating and other purposes. Send for illustrated circular. W. Hochhausen, 132 William St., New York.

"Abbe" Bolt Forging Machines and Palmer Power Hammers a specialty. Send for reduced price lists. S. C. Forsaith & Co., Manchester, N. H.

400 new & 2d hand Machines, at low prices, fully described in printed lists. Send stamp, stating just what you want. S.C. Forsaith & Co., Manchester, N. H.

Driving Belts made to order, to accomplish work required. Send full particulars for prices to C. W. Arny, 148 North Third St., Philadelphia, Pa.

Celebrated John Scott Scroll and Jig Saws made to order, of Jessup's superior cast steel, by I. Roberts, 108 Hester Street, New York. Send for circular.

Scientific American—The early Volumes for Sale—very cheap—either bound or in numbers. Address A. F. R., Box 773, New York City.

Hydrant Hose, Pipes, and Couplings. Send for prices to Bailey, Farrell & Co., Pittsburgh, Pa.

Machine-cut brass gear wheels, for models, &c. List free. D. Gilbert & Son, 212 Chester St., Phila., Pa.

"Dead Stroke" Power Hammers—recently greatly improved, increasing cost over 10 per cent. Prices reduced over 20 per cent. Hull & Belden Co., Danbury, Ct.

Power & Foot Presses & all Fruit-can Tools. Ferracute Wks., Bridgeton, N.J. & C. 27, Mchy. Hall, Cent'l.

Shingles and Heading Sawing Machine. See advertisement of Trevor & Co., Lockport, N. Y.

Steel Castings, from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills Pittsburgh, Pa., for lithograph, &c.

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street, New York.

Diamond Tools—J. Dickinson, 64 Nassau St., N. Y.

Temples and Oilcans. Draper, Hopedale, Mass.

Notes & Queries

J. R.'s observations on scarlet fever and diphtheria have been handed to a prominent physician for reply.—T. E. is informed that we do not know the article he mentions.—W. H. H. can protect his iron castings from rust by the means described on p. 169, vol. 33.—G. A. C. is informed that writing paper is glazed by rolling it under immense pressure.—J. R. will find recipes for bronzing iron on brass on p. 283, vol. 31.—J. C. G. can raise the pitch of his tuning fork by filing it shorter. It cannot be lowered without lengthening it.—W.H. H.'s idea as to burning steam is a chimera.—A. K. will find a good recipe for indelible ink on p. 129, vol. 28.—C. J. C. is informed that the oxyhydrogen light will probably suit his purpose.—E. W. M. should address the Signal Service Bureau, Washington, D. C.—M. D. K. will find a recipe for a fugitive ink on p. 267, vol. 34. Straw hats can be bleached by the process described on p. 11, vol. 32.—F. A. L. will find that chloride of calcium will absorb the moisture in his refrigerator.—C. K. W.'s idea that machinery runs better at night than in the daytime is perfectly absurd.—C. A. F. will find a recipe for fulminating powder for cartridges on p. 90, vol. 31.—B. F. K. will find a good recipe for ink on p. 250, vol. 34.—A. C. G. will find that the proportions of an induction coil are fully described on p. 344, vol. 33.

(1) M. E. B. says: Please give me a recipe for removing stains from marble table tops, supposed to be caused by lemon juice? A. If the stains mentioned are from lemon juice, they cannot be removed, as the organic acids they contain attack and disintegrate the marble. Try moistening the spots with benzole and covering with hot pipe clay. If this does not remove them, it will be necessary to resort to mechanical means.

(2) F. G. asks: By what rule do the "Farmer" and "Family" almanacs give the times of rising and setting of the sun? A specimen now before me gives, for example, on November 1, sunrise, 6h. 29m.; sunset, 4h. 59m. Now assuming the time for rising to be correct, that time, taken from 12 hours, would leave 5h. 31m. as the correct time of setting. Here is an error of 32 minutes. A. On November 1 the sun is south of the equator 14° 33′, the length of the day 10 hours 30 minutes; one half of this, 5h. 15m. subtracted from 12, would make the sun rise at 0.45, but the sun is fast of true time 16 minutes on this day. This makes him rise at 6.29, and set 16 minutes earlier, 4.59, making the forenoon 32 minutes longer than the afternoon. There are only four days in the year in which the sun is on time, April 15, June 14, August 31, and December 24.

Does the attraction of magnetism vary as the square or cube of the distance? A. There are some cases in which it varies inversely as the cube, but the attraction of terrestrial magnetism varies inversely as the square, of the distance.

(3) C. M. asks: What is the number of threads per inch on the "society screw" of microscopical objectives? A. Fifty-five.

(4) D. H. asks: What color of paper is best to write upon, for a person having weak eyes? A. Green or blue, or an intermediate color, if there is light enough not to tax the eyes, as these colors reflect very little of the heat rays.

(5) E. O. K. asks. 1. Please give me a recipe for making a bright red mortar for pointing a foundation wall? A. Take Spanish brown, dry, and mix in with common lime mortar; color to suit. 2. Would red lead be affected by the lime? A. That you can try by experiment; a day or two would show.

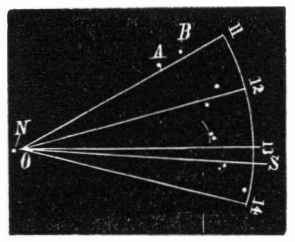
(6) S. P. M. says: What size of paddle wheels do we need on a steamer 45 feet long, and 10 feet wide at the bottom? She is built sharp at both ends, and draws, when loaded, from 14 to 18 inches of water. We have a 10 horse engine to run her, and plenty of power to spare. A. By using 10 feet wheels with your present engine, you might obtain a speed equal to 7 miles an hour, or you might get even better results by using feathering wheels of the same diameter as the present ones, 7½ feet.

(7) J. D. E, says: The flint glass of my telescope is very hazy, having a scum or smoky appearance on the outside, which will not wipe off. How can I remedy it? A. This trouble is quite common with heavy flint glass, and the only way to remove it is by polishing. When it is not very thick it can be removed by polishing with rouge on a piece of chamois leather. If this does not remove it, take a piece of yellow beeswax and make a polisher about one third the diameter of the lens. With this and a little rouge and water the lens may be cleaned. Care should be taken to go all over the glass evenly.

(8) E.G.F. asks: Can you tell how to remove a bad echo from a schoolroom, 26 x 29 feet, with 12½ feet pitch? The teacher's desk is at one end of the room, between two doors, on a slightly raised platform. The stove is a little in front of the platform. A recitation seat runs along the sides of the room, and between are low chairs and desks for nearly 100 scholars. There are three windows on each side, and two in the end opposite the doors. Teachers complain of sore throats and tired lungs after having charge of the room a short time, of a confusion of sounds when the scholars are only moderately restless, and of the great difficulty in rightly locating any noise. The room is so hard to teach in that a partition, an addition, or any reasonable remedy is to be tried if we can learn what will be best. A. It probably will be found that the difficulty in this case arises from the bad shape of the room, it being nearly square. It has been found that long and narrow rooms, with the speaker at one end, have been the best for the voice. The auditorium of the Academy of Music, which is the principal opera house of this city, is a good example of a room of this kind. If you should partition off a small room in the corner upon each side of the platform, you might help it: say 9 feet wide and 12 feet long, triangular, with the partition you insert curving outwardly towards the platform upon a radius of 13 feet.

(9) F. H. N. says: In the house I live in is a well, running down from the skylight, 8 feet x 3 feet in dimensions, for the purpose of conveying light and ventilating some rooms which have no opening on the street, and which, otherwise, would be dark and close. Now it is a great source of annoyance that all conversation on the fourth floor can be heard in the lower rooms, and *vice versa*. Can you tell me of any means or method that may be employed by which this may be obviated? Could it not be done by means of crossed wires, that is to say, wires crossing each other at angles of about 45°? A. We have no information that would warrant the success of such a plan. Can you not put in a horizontal sash, and procure means of ventilation in some other way?

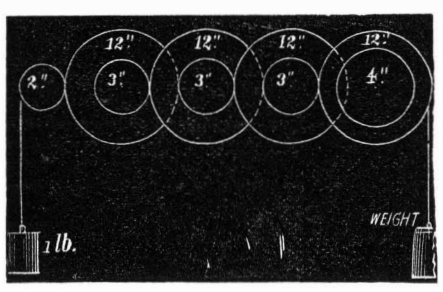
(10) C. H. asks: How may I find when the north star is on the meridian, by reference to the stars in the Dipper? A. The line, N S, represents the meridian, N the north star, O the north pole, and the lines O—11, o—12, etc., are 1 hour apart, and show sidereal time. A E are the Pointers. It will be seen that the north star and



the next to the last star in the handle of the Dipper are on opposite sides of the poles, so that when a plumb line will bisect both, they indicate the true meridian very nearly. They now pass the meridian between 5 and 6 o'clock.

(11) W. W. L. says: About four years ago, I made an upright refrigerator; but not liking the metallic taste which a metal lining gives to food, I left it unlined, but very foolishly varnished the wood inside, in consequence of which nearly every article of food placed in it tastes of the varnish. I have tried scraping and scrubbing the wood, but the smell and taste of varnish still remain. Will a coating of shellac remedy it? If not, what will? A. Coat the interior evenly with melted paraffin. It should be applied rapidly with a good brush, and is perfectly tasteless and inodorous.

(12) W. C. A. says: The inclosed drawing will show you four 12 inch gear wheels working into 3 inch ones, the last one to the left being a 2 inch. The cord at the right runs off a drum 4 inches in diameter. What amount of weight will be required to lift the 1 lb. at the left, and what is the rule for calculating the power of gears



or the amount of weight required to move them? A. Disregarding friction, the power and weight are to each other in the inverse ratio of the distances passed over by each in the same time. 2. Is there any rule for calculating the power of coil springs? A. The power of a coiled spring is the product of the force with which it tends to unwind multiplied by the distance passed over by the point of application of the force in a given time.

(13) A. I. asks: Can you recommend with a certainty of success some inexpensive formula to preserve cider? Your recipe as follows: "To 1 barrel of new cider, add ½ part sugar and 2 handfuls of fish sounds to clarify. Let stand two weeks in cool place, then rack off into a well washed cask or barrel, and add from 1 to 2 dozen whites of eggs; let stand another two weeks, and then rack off into another barrel. Add finally 2 gallons of whisky, stirring well, then bottle. This cider will keep sweet through the summer." What do you mean by ½ part sugar? A. The recipe as given is a good one, with the exception that the proportion of sugar should have been stated more definitely as about 3½ lbs. to the barrel. If the liquid is bottled, the bottle containing it should first be placed with loosened stopper in a vessel of water, the temperature of which should then be gradually raised to about 180° Fah. and the bottle tightly stoppered and allowed to cool.

(14) F. B. L. asks: What can I put fruit up in so as to preserve it in its natural form and color? I want to carry the fruit round as samples. A. Try a weak solution of good carbolic acid in alcohol.

(15) J. H. G. asks: 1. How may I distinguish pure rubber? A. Pure rubber is of a dark, semi-transparent nature, quite elastic, but easily indented with the teeth; in hot water it swells up and becomes quite plastic. 2. How is rubber dissolved in a liquid, and how long does it take? A. When plastic it should be placed in the solvent; hot naphtha or benzole is preferred, the rubber having been previously cut into as small shreds as possible. In this condition it swells up very considerably and partially dissolves in a few hours. In order to obtain a rubber cement, the solution, together with the softened pasty mass, which should be well stirred and kneaded during the operation, may be evaporated down over a water bath, until of the proper consistence.

(16) Mrs. W. C. A. asks: 1. Is there any danger of incurring diseases from using water from a well which has not been used for about 1 year? A. If the water contains any notable quantity of organic matter, there is. 2. Is there any way to purify the water if it is not fit to use? A. One of the best remedies is to keep the water running for some time before attempting to use it. The addition to the water of a quantity of finely crushed, well burnt charcoal would also be advisable under the above circumstances.

(17) W. R. B. says: I have some vinegar which I cannot clarify. I have tried sand and charcoal in a barrel, but it does not clear it. Would you advise anything in preference to a charcoal filter? A. Try the following: Warm some finely crushed charcoal or bone black, throw this into the vinegar and stir occasionally for about 24 hours; then draw off the vinegar, mix with a quantity of common (clean) paper pulp, and filter through a bag of fine linen.

(18) A. B asks: Please give me a recipe for making a polish for wooden turned work, to be used on the work while in the lathe? A. Try a mixture of boiled oil and turpentine, well rubbed in with pieces of rag. 2. Is there any other method of bluing iron or steel than by heating it? A. Dissolve 4 ozs. hyposulphite of soda in 1½ pints of water, and then add a solution of 1 oz. acetate of lead in 1 oz. water. Place your articles in the solution, and heat to the boiling point. Your articles, if of iron or steel, will be blued.

(19) A. B. says: We have two engines, 7 inches bore and of 12 inches stroke, attached to one shaft. They have reversible link motion, and are each provided with the ordinary slide valve. They make 175 revolutions per minute with a pressure of steam of 85 lbs. to the square inch. One of the engines has too much lead when on either center. We have tried several plans to shorten the stroke of the valve, but without any success. Will you please give us some information? A. You must take the lead off your valve by setting the eccentric back

(20) W. B. asks: 1. Can charcoal be obtained in a liquid form for commercial purposes? A. There is no solvent for charcoal. 2. How can oils be filtered through charcoal, and the oil residuum remaining in the charcoal be extracted and saved? A. Digest the charcoal with the adhering oil in bisulphide of carbon. The oil may be recovered by distilling off the volatile bisulphide in a suitable retort, at a gentle temperature

(21) J. C. ask: I have an iron pipe conveying water from a cistern for culinary and other purposes. The water becomes so highly impregnated with iron as to render it quite unpalatable. A. Add a little clean lime water (experience will teach you the proper quantity) and filter through a sand and charcoal tub.

(22) J, S. F. asks: How is the lime water mentioned on p. 7, vol. 34, prepared? A. Digest a quantity of good quicklime in pure water for some hours, with occasional shaking; allow to settle and draw off the clear transparent liquid without disturbing the residue. It should be kept from contact with the air when not in use.

In steam or vapor baths, how is the steam handled so that the heat does not affect the person? A. The steam simply imparts its heat and a portion of its moisture to the air by actual contact.

1. The water here (among the San Fernando Mountains, Cal.) is of several kinds. Some springs contain small quantities of petroleum, others alkali, others sulphur, iron, and alkali. The ground over which the latter springs run, and boards with which the water comes in contact, become heavily coated with a bright yellow substance like rust; while on the surface of the surrounding soil, a thick white coat of alkali forms. Can anything be done to such water to make it fit to drink? A. We do not think it would be practicable under the circumstances. 2. One spring or well 8 or 10 feet deep, by the side of a now dry stream, has no bad taste, but the water makes the excrements almost black, and causes diarrhœa. What does the water contain, and what is the yellow substance mentioned? A. It is probably due to the large quantity of iron and sulphuretted hydrogen it contains. The deposit probably consists chiefly of the hydrated sesquioxide of iron

(23) A. H. says: In what should I boil cider so as to make a good article, free from foreign color or taste? Would an iron or copper kettle do? A. It would be better to use a tin vessel or one of cast iron, porcelain-lined. The vegetable acids corrode both iron and copper.

(24) F. D. H. asks: Are the connecting rods of the locomotive at the Centennial, built by apprentices, of the character shown in Fig. 1, p. 490, SCIENTIFIC AMERICAN SUPPLEMENT, that is, with simple eyes, without means provided for taking up the wear? A. No.

(25) C. W. S. asks: What will remove deeply set tea stains from an oak table? A. Try a little ether and alcohol.

(26) A. F. G. says: 1. I have 500 lbs. leaf tobacco, of such a bright color that cigars made with it find no acceptance. What ingredients should I use to make a compound with which to give the cigars a deeper color? A. We understand that in similar cases it is a practice of some manufacturers to make an extract of the stems and other waste of the leaf by boiling the same in water, and afterwards concentrating the solution by evaporation until a very strong liquid is obtained. To this is added the various essential oils, etc., the precise nature of which is strictly kept from the public as a "trade secret." The leaves to be colored are then dipped in the preparation and dried until of the required shade. 2. I have also some very good Pennsylvania tobacco to which I would like to give the aroma of Havana tobacco. How should I make a preparation of Havana tobacco that the Pennsylvania leaf can be darkened with, that would give the tobacco an Havana taste? A. Various means similar to that given above are constantly employed, with varying success to impart to baser leaves the peculiar flavor of Havana tobacco; but we are not prepared to give to the public the precise methods.

(27) N. says: I use a copying ink pencil (made of aniline, I suspect). Can you inform me of the quickest and easiest mode of copying letters written by this pencil without using a press? A. Try thin paper moistened with a little dilute gum water and alcohol.

(28) E. C. B. says: I frequently have to clean watches which have fallen into the sea, and the steel parts get rusty. I have tried putting them in soda water and then soaking in oil, but all to no use; for after 2 or 3 months the rust will reappear as bad as ever. Will you please tell me the best remedy? A. Try a little very dilute sulphuric acid. After removal from the acid, wash

© 1876 SCIENTIFIC AMERICAN, INC.

quickly and cover with warm pipe clay for a time. The working parts should be polished perfectly before attempting to replace them in the watch.

(29) W. C. W. asks: What process or preparation will prevent strips of lead from blacking the hands? A. Coat them with a thin covering of varnish or melted paraffin.

(30) B. & B. say: We wish to build a large brick factory, 50 x 100 feet, four stories high, and wish the three upper stories to be damp or sweat proof. What is the best mode of building it? A. Build hollow walls laid up in a good cement mortar.

(31) J. McT. asks: 1. Will concrete do for a cellar wall and foundation for a frame building? A. Yes. 2. Will common lime do to mix it with, or will it require cement, or some of each? A. Pure cement is best.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Newspaper Subscriptions. By J. H. P.

On Marine Propulsion. By R. F.

On a Discovery in an Ancient Temple. By J. E. W.

On a Body in a Hollow Sphere. By J. W.

On the Material Theory of Light. By G. L. B.

Also inquiries and answers from the following:

J. C. W.—J. G. A.—W. D.—U. R. D.—J. S.—W. M.—G. C.—C. S.—S. P. F. F.—C. Z.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes marbleized slate? Whose is the best steam-heating apparatus? Who sells the most accurate barometers? Why do not makers of agricultural implements advertise in the SCIENTIFIC AMERICAN?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

July 25, 1876,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Air brake and signal, G. Westinghouse, Jr..... 180,174
Anchor, R. M. Robinson..... 180,378
Arch, hollow tile, F. J. Kennedy..... 180,240
Bag holder, J Mulder..... 180,151
Bag holder, G. M. & J. Robinson..... 180,273
Bale hoop iron, W. B. Hayden..... 180,129
Bale tie, J. H. Snyder..... 180,388
Barb former, Wilson & Bartlett..... 180.405
Base ball, W. B. Carr..... 189,110
Basin, wash, H. Berkele..... 180,188
Bath, depurator, W. Curran..... 180,328
Bed bottom, spring, B. H. Otis (r)..... 7,239
Bed bottom, spring, J. Turner..... 180,392
Bed spring, J. Reardon..... 180,269
Bedstead, H. B Coyle..... 180,326
Bedstead, sofa, S. Graves..... 180,220
Bell, call, Bradley & Stratton..... 180,191
Billiard table leveler, S. May..... 180,251
Bird cage, G. F. J. Colburn..... 180,204
Bird cage, A. Heinz..... 180,232
Blotter, paper cutter, etc., T. L. Montgomery... 180,362
Bobbin, T. Mayor..... 180,145
Boiler spark arrester, F. M. Stevens..... 180,283
Bolt, door, F. L. Kleyensteuber..... 180,353
Books, gathering signatures of, E. D. Averell.... 180,103
Boots and shoes, D J. Rogers.....180,276, 180,376
Boot heel stiffener, J. L. Hatch..... 180,340
Boot, rubber, Hayward & Burlingame..... 180,231
Boots, exhibiting, Brown & Frazier..... 180,192
Boots, uniting uppers and soles of, G. McKay..... 180,146
Bosom pad, A. W. Thomas..... 180,173
Bottle attachment, Hoard & Bastine..... 180,132
Bottling machine, water, G. Wenker..... 180,294
Bouquet holder, G W. Tucker..... 180,170
Box, packing, S. C. Cary..... 180,198
Brick, fire, J R. Thomas..... 180,391
Bridle bit attachment, T. M. Allen..... 180,184
Brush, J. S. White..... 180,296
Buckle, harness, B. F. Frazier..... 180,219
Bung extractor, F. Mayr..... 180,357
Burial case, T. E. Daniels..... 180,207
Burner and surgical instrument, C. A. Paquelin.. 180,155
Burner, argand gas, M. F. Gale..... 180,336
Bustle, A. W. Thomas..... 180,172
Butter package, M. W. Spaulding..... 180,389
Butter tub, J. E. Higgins..... 180,234
Can, meat, J. Lundgren..... 180,140
Can, milk, J. Smiley..... 180,383
Cans, making metallic, F. Marquet..... 180,356
Car axle lubricator, J. D. Clute..... 180,112
Car coupling, L. P. Bailey..... 180,310
Car coupling, W. N. Hutchinson..... 180,346
Car coupling, J. Maloy..... 180,141
Car coupling, H. Pitcher..... 180,266
Car for railways, sliding, J. Westcott..... 180,400
Car seals, machine for making, H. Guels..... 180,124
Car wheel, J. W. Emerton..... 180,212
Car wheel, A. S. Levake..... 180,247
Car window, W. L. Everit..... 180,213
Car window, A. B. Pullman..... 180,158
Carbureter, McMillen & Minor..... 180,359
Carpet stretcher, L. W. Rivers..... 180,272
Carriage top bow iron, G. H. Ely..... 180,332
Cartridges, etc., tool for capping, I. & Z. Zamboni 180,305
Chair, folding, J. E. Wakefield..... 180,292
Chimney, metallic, P. S. Smout..... 180,386
Churn, Patterson & Williams..... 180,154
Churn, S. B. Robison..... 180,275
Clock, F. Kroeber..... 180,138
Clothes dryer, C. E. Ball..... 180,312
Clothes dryer, D. J. Clark..... 180,203
Clothes dryer, R. A. & F D. Winters..... 180,300
Clothes pin, G. W. Newbegin..... 180,153
Clothes pounder, C. A. Dodge..... 180,210
Compass, drafting, H. Morgan..... 180,150
Cooking utensil, A. Arfvidson..... 180,308
Cooking utensil, F. Myers..... 180,365
Copy holder, C. R. Brainard..... 180,106
Corn husker, hand, J. Peters..... 180,157
Corpse cooler, Truesdell & Townsend..... 180,175
Corset, J. D. Banfield..... 180,313
Cotton chopper, T. C. Burnham..... 180,195
Cotton feeder and cleaner, G. F. Colquitt..... 180,206
Culinary apparatus, J. W. Johnson..... 180,347
Cultivator, O. Kugler..... 180,354
Cultivator, D. F. Vickery..... 180,396
Cultivator, sulky, S. A. Buchanan..... 180,319
Cultivator, wheel, W. N. Riddle..... 180,271
Curry comb, W. E. Lawrence (r)..... 7,238
Curtain fixture, N. Campbell..... 180,109
Curtain fixture, F. A. Vredenburgh..... 180,291
Curtains, suspending, D. Calhoun..... 180,108
Cutter head, M. Buck..... 180,320
Dental flask, W. E. Buckman..... 180,193
Derrick, field, J. Q. Grinnell..... 180,223
Desk, school, C. J. Higgins..... 180,233
Dock block, F. S. Burr..... 180,107
Drill chuck, G. B. Cubberley..... 180,117
Drills, etc., twist, G. B. Cubberley..... 180,118
Earth-boring machine, Price & Morgan..... 180,268
Elevator, T. K. Austin..... 180,186
Elevator bucket, H. A. Duc, Jr..... 180,329
Elevator, passenger, C. H. Mitchell..... 180,361
Engine for compressing air, C. Moore..... 180,363
Engine, cut-off gear, F. Douglas..... 180,211
Engine valve motion, S. H. Wheeler..... 180,401
Engine valve regulator, H. S. Cole..... 180,205
Envelopes, J. Chapman.....180,199, 180,200
Fan, automatic, Fitzhugh & Renner.....180,123
Fan, automatic, L. E. Haack..... 180,337
Felly plate, S. Sneden..... 180,163
Fence, portable, E. F. Bunn..... 180,321
Fence post, H. Reynolds..... 180,159
Fence post, I. L. Sherman..... 180,379
Fence wire, barbed, G. W. Allen..... 180,185
Fifth wheel platform, A. H. Beach..... 180,316
Filter, funnel, Paul & Ramer..... 180,368
Fire arm, breech-loading, C. Foehl..... 180,916
Fire escape, M. Durand..... 180,209
Fire escape, T. McClunie..... 180,252
Fire kindler, R. C. Lewis..... 180,248
Flower stand self-watering device, J. B. Kniest. 180,242
Forge, smith's, D. Ebbinghaus..... 180,330
Fruit, preserving, L. Bradley..... 180,318
Furnace, R. L. Walker..... 180,178
Furnace, gas-burning, R. S. Robertson, Jr..... 180,274
Fuse lighter, J. W. Platt..... 180,267
Galvanizing machine, G. R. Acheson..... 180,182
Game counter, A. D. Hoffman..... 180,235
Garbage receptacle, A. Schmitt..... 180,277
Gas, matter for making, S. Green..... 180,221
Gas faucet, W. A. Wales..... 180,397
Gas retort cap, J. Balmore..... 180,104
Gas shade holder, Dodson & Macqueen..... 180,119
Gas stove, J. A. Frey..... 180,334
Gate, farm, R. Whitlock..... 180,297
Gates, hanging, E. Shopbell..... 180,380
Generator, steam, W. E. Haxton..... 180,127
Glass-melting pot, A. Harcum..... 180,226
Glove, J. Peters..... 180,156
Governor, W. A. Hathaway..... 180,341
Grain binder, J. O. Schuster..... 180,377
Grain binder, E. R. Whitney..... 180,402
Grain cradle fingers, shaping, A. Denney..... 180 208
Grinding ring, H. Packer..... 180,263
Grinding rollers, machine for, J. M. Poole (r)... 7,240
Harvester, corn, E. Atkinson..... 180,102
Harvester elevator, E. McFadden..... 180,253
Hasp and latch, N. S. Minniss..... 130,148
Hatchets, etc., welding heads on, H.C. Reynolds 180,270
Hay for fuel, etc., twisting, J. S. Foster..... 180,218
Heater and feeder, M. Cabbell..... 180,197
Heater trough, D. W. Marmon..... 180,249
Hinge, A. Barker..... 180,314
Hinge for trunk trays, J. Heiser..... 180,130
Hinge, trunk, J. Heiser..... 180,129
Hitching device, Craine & Gaylord..... 180,327
Hog cholera, remedy for, W. J. Woods..... 180,303
Hoisting machine, J. Bates (r)..... 7,236
Hook, snap, N. E. Cissna..... 180,202
Hook, snap, L. W. Timmens..... 180,174
Horse-power machine, chain, Ellis *et al*..... 180,331
Horses, detaching, J. K. Craig..... 180,322
Horse-fastening attachment, W. B. White..... 180,295
Horseshoe nail, P. Wineman..... 180,181
Horseshoes, making, Archer & Turner..... 180,101
Hose connection, H. Kessler..... 180,241
Hydrant, H. E. Clover (r)..... 7,243
Ice implement, A. E. Hanford..... 180,339
Insect powder gun or ejector, C. T. Jewett..... 180,135
Ironing apparatus, R. H. Gardner (r)..... 7,237
Ironing board, E. Albert..... 180,307
Ironing board, C. H. F. Kruse..... 180,243
Kiln, brick, W. S. Colwell..... 180,113
Kilns, furnace for brick, W. S. Colwell..... 180,114
Knife and screw driver, putty, C. C. Bartlett..... 180,187
Knitting machine, M. Marshall..... 180,250
Knitting machine stop, Williams & Irons..... 180,401
Knob spindles, fastening for, H. W. Trefethen.. 180,288
Lamp, J. H. Irwin..... 180,134
Lamp, blast, R. Lavender..... 180,246
Lamp, miner's, J. C. Moore..... 180,253
Lamp, street, J. S. Woods..... 180,302
Lapping machine, Schofield & Wilde..... 180,161
Lard, etc., from coolers, drawing, D. Pinger.... 180,265
Latch, gate, S. O. Hall..... 180,338
Latch, gate, C. J. Wallis..... 180,293
Latch, knob, C. S. Jennings..... 180,239
Limekiln, Farrell & Lien..... 180,214
Line fastener, C. Hoag..... 180,343
Lock and latch, H. R. Towne..... 180,287
Lock, combination, I. D. Sibley..... 180,278
Lock, combination, J. H. Woodrum..... 180,301
Lock, latch, D. K. Miller..... 180,255
Lock, seal, G. B. Phillips..... 180,371
Lock, time, Overmyer & Huston..... 180,262
Locks, time attachment for, J. L. Hall..... 180,227
Locks, time attachment for, Hall & Gross..... 180,228
Locomotive tenders, coaling, Fuller & Merriam. 180,335
Locomotives, condenser for, H. Hughes..... 180,345
Loom, S. T. Thomas..... 180,171
Magnet and relay, electro, R. E. House..... 180,100
Magnet, electro, R. E. House..... 180,993
Mandrel, expanding, S. P. M. Tasker..... 180,169
Meat chopper, N. A. Olsson..... 180,261
Mill, grinding, E. & D. Moore..... 180,257
Mill, grinding, J. A. Moore..... 180,149
Mill, grinding, F, Steimmig..... 180,167
Millstones, stalling and dressing, Sewell *et al*.... 180,378
Molding plastic material, W. H. Smith..... 180,384
Nail-plate cutter, G. P. Clapp..... 180,324
Nuts, manufacture of, J. Sutter..... 180,285
Oil cloth, saturated felted, C. A. Sitzler..... 180,382
Ores, nickel, treating, Mason *et al*..... 180,142
Oven, hot blast, W. Crossley..... 180,116
Packing, deep well, F. Martin (r)..... 7,244
Pail and tub ear, G. W. Stark..... 180,164
Pail, milk, N. McKusick..... 180,254
Pantaloons, shaping, C. H. P. Kruse..... 180,244
Paper boxes, cylindrical, H. Kellogg..... 180,350
Paper cop tube, J. McCausland..... 180,358
Paving block, H. E. Merrill..... 180,360
Photographic picture case, T. F. Adams..... 180,183
Photographs, vignetting, L. D. Judkins..... 180,136
Piano, violin, G. Greiner..... 180,222
Pinchers, wire fence barb, C. Kennedy..... 180,351
Pipe mounting, tobacco, J. J. Lang..... 180,245
Planing and sawing lumber, W. H. Parcher..... 180,367
Planing feed and pressure roller, Brown *et al*. (r) 7,242
Plow, gang, S. Kirkpatrick..... 180,137
Plows, cleaning, J. H. Storm..... 180,166
Pockets for garments, safety, R. Phillipson..... 180,372
Postage stamp, P. H. Vander Weyde..... 180,394
Powder can and cartridge case, P. A. Oliver..... 180,366
Press, horse power, Z. B. Sims..... 180,381
Press, hydraulic, Hyatt & Crane..... 180,133
Press, lard, P. Pemberton..... 180,264
Pulley block, J. & C. J. Herweg..... 180,342
Pump, S. S. Robinson..... 180,375
Pump, pitcher, S. L. Bignall..... 180,190
Railway drawbar and buffer, N. B. Eccleston..... 180,121
Railwayfrog, D. W. Payne..... 180,369
Railway frog, T. E. Vickers..... 180,395
Railway rail, street, C. T. Hopkins..... 180,237
Railway rails, machine for slitting, J. Reese..... 180,373
Railway switch, B. R. Murphy..... 180,364
Rake, R. P. Walker..... 180,398
Rake, lawn, C. Hertzig..... 180,131
Range, T. A. Carrington..... 180,323
Range, heater, C. A. Smith..... 180,385
Register, J. A. Sternberg..... 180,165
Rein holder, J. W. Miller..... 180,256
Ring blanks, forming metal, J. Adt..... 180,306
Roof, battened, C. W. Sykes..... 180,168
Sash fastener, C. W. Saladee..... 180,160
Saw-sharpening machine, M. Covel..... 180,115
Scales, weighing, H. Willard..... 180,298
Scoop and sieve, L. Kelm..... 180,349
Screwdriver, A. Stoner..... 180,284
Screws, cutting nicks in, T. J. Sloan.....180,280, 180,281
Separator, grain, W. Holladay..... 180,236
Sewing machine binder, J. Van Leunen..... 180,177
Sewing machine, glove, Gullrandsen *et al*..... 180,225
Sewing machine spinner, J. E. Snapp..... 180,387
Shackle, hand, A. P. Baldwin..... 180,311
Shafts, divided collar for, J. Yocom, Jr..... 180,304
Shooting gallery, parlor, H. J. Kintz..... 180,352
Sifter, ash, J. E. Eastlack..... 180,120
Sleigh, Erickson & Newstrom..... 180,122
Soap, S. Strunz..... 180,390
Spinning frame and twister, T. Mayor..... 180,144
Spinning machinery, ring, T. Mayor..... 180,143
Spoke-setting machine, A. F. Flint..... 180,333
Spoon and fork, L. S. White..... 180,403
Stables, releasing device for, A. Chapman..... 180,201
Stamp, perforating and canceling, C. Armstrong. 180,309
Steamer, culinary, L. C. Light..... 180,139
Still, steam, A. F. W. Neynaber..... 180,260
Stone-sawing machine, W. C. Huffman..... 180,344
Stool, adjustable, T. Miller..... 180,147
Stove, C. R. Sipes..... 180,279
Stove covering, A. J. Vandeventer..... 180,289
Stove, gas, J. A. Frey..... 180,334
Stove, heating, Little & Nation..... 180,355
Stump extractor, Burroughs & Story..... 180,322
Tackle block, Simpson & Pope..... 180,162
Tank, oil, J. M. Bean..... 180,317
Telegraphs, R. E. House..180,089,-090,-091,097,-099, 189,092
Telegraph, fire alarm, H. W. Spang..... 180,282
Telegraph sounder, R. E. House..... 180,094
Telegraph wires, joining, R. E. House..... 180,698
Telegraph code, R. E. House..... 180,096
Telegraph symbols, measuring, R. E. House..... 180,095
Thimble, G. H. Finger..... 180,215
Tires, casting, N. Washburn..... 180,399
Tobacco pipe mounting, J. J. Lang..... 180,245
Tool handle socket, C. A. Hardy..... 180,126
Toy bell, L. D. Butler..... 180,196
Toy marble rake, Gurny, Piper & Waite..... 180,216
Trap, animal, Bates & Borgersrode..... 180,315
Umbrella, cane, C. W. Carson..... 180,111
Vehicle propeller, T. H. Neal..... 180,259
Vessels, raising sunken, E. E. Tassey..... 180,286
Washing machine, J. H. & J. H. Harnly..... 180,230
Washing machine, B. J. Murray..... 180,152
Washing machine, W. H. Tutt..... 180,393
Washing machine, W. H. Willis..... 180,299
Washing machine, A. B. Wroth..... 180,406
Watch escapement, F. H. Voigt..... 180,290
Water wheel, T. J. Alcott (r)..... 7,241
Weather strip, E. C. Underwood..... 180,176
Weather strip, W. P. Widdifield..... 180,180
Weeding implement, D. N. Ford..... 180,217
Whiffletree connection, Ingersoll & Fisher..... 180,238
Windmill brake, Bignall, Whittlesey & Goodhue. 180,189
Wool-washing machine, Pendleton & Proctor... 180,370
Wrench, B. F. Joslyn..... 180,348
Wringer, J. W. Hall..... 180,125
Wringer rolls, with rubber covering, H. W. Burr 180,194
Yarn, spooling, J. B. Bancroft..... 180,105
Yeast compound, dry, C. W. Gschwind..... 180,224

DESIGNS PATENTED.

9,405.—TEA SETS.—W. C. Beattie, Taunton, Mass.
9,406.—CASKET HINGES.—R. H. Burr, West Meriden, Conn.
9,407.—CHANDELIERS.—P. J. Clark *et al*., West Meriden, Conn.
9,408.—CARPETS.—J. Hamer, Dutchess county, N. Y.
9,409.—CARRIAGE CLIPS.—M. Seward, New Haven, Conn.
9,410.—TRIMMING.—L. Sutro, New York city.

[A copy of any one of the above patents may be had by remitting one dollar to MUNN & Co., 37 Park Row, New York city.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
On each Trade mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On filing a Disclaimer	$10
On an application for Design 3½ years)	$10
On application for Design (7 years)	$15
On application for Design (14 years)	$30

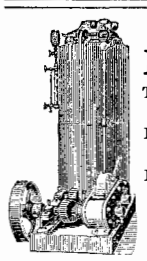
THE VALIDITY OF PATENTS.

The inexperienced purchaser of a patent does not generally appreciate the importance of having its claims examined, and their validity and scope defined by some person experienced in such matters, before parting with his money. It is not unusual for the assignee, just as he is commencing the manufacture of articles under his recently purchased patent, to find that it is an infringement upon some previously issued patent, and that he has not only made a worthless investment, but that he is likely to get mulcted in damages if he proceeds with his manufacture. Cases are continually coming to our knowledge wherein parties have made purchases in good faith, and paid considerable sums of money on the assurances of the patentee and a mere glance at the patent, presuming that all that the drawing of the invention showed was protected by the claims, when, in fact, the point covered was almost infinitesimal. Another manner in which purchasers are sometimes deceived is that the claims, although broad enough and worded properly to cover the invention, contain a single element protected by some prior patent, which covers the very part in the new machine which is necessary to insure its efficiency. The Howe sewing machine patent illustrates this. It protected but little that any of the manufacturers cared to use, except the one small part essential to all sewing machines; and all manufacturers had to pay Howe a royalty, and he derived from that apparently trivial item an immense income.

We therefore recommend any person who is about to purchase a patent, or about to commence the manufacture of any article under a license, to have the patent carefully examined by a competent party, and to have a research made in the Patent Office to see what the condition of the art was when the patent was issued. He should also see that the claims are so worded as to cover all the inventor was entitled to when his patent was issued; and it is still more essential that he be informed whether it is an infringement, as above suggested, or not. Parties desiring to have such searches made can have them done through the Scientific American Patent Agency, by giving the date of the patent and stating the nature of the information desired. For further information, address MUNN & CO.,
37 PARK ROW, New York.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.



GALLAHUE'S
Little Giant Engine.

The most Durable, Cheap, Compact, Economical Engine offered to the public.
Price 4 Horse Power..... $275
" 6 " 325
" 8½ to 10 " 425
Price of Engines separately:
" 4 Horse Power..... $125
" 6 " 140
" 8½ to 10 " 200
Send for illustrated circular.
A. C. GALLAHUE & CO,
Morrisania Station, N. Y. City.

BIG PAY to sell our RUBBER PRINTING STAMPS. Terms free. TAYLOR & Co, Cleveland, O.

WANTED—To Manufacture some Patented Article, either wood or metal, of acknowledged merit, on royalty—when exclusive right for the northwest can be had. Address R.M.P., Rockford, Ill., Box 862.

A MACHINE FOR RUNNING MACHINERY by Weights.—The Inventor requires means to procure a Patent and place it in the market. Parties with means, please address JOHN N. PARRISH, Wethersfield, Baltimore county, Md.

UNITED STATES PATENT ASSOCIATION.
A meeting of this Society will be held at the Hall of the Franklin Institute, in the City of Philadelphia, on Thursday, September 7th, at 11 o'clock, A. M
The special questions for consideration at this time will be the improvement of our own system, and the formation of an international association having reference to a greater uniformity among the systems of the world.
Inventors, Owners of Patents, Manufacturers of Patented Articles, and all who are interested in the subject, are invited to be present and to co-operate in this movement.
Visitors from abroad are specially invited to take part in the proceedings. JOHN S. PERRY, President.
CHARLES F. STANSBURY, Secretary.

DRAIN PIPE MACHINERY.—Models at Centennial Exhibition, Machinery Hall, Post A, 55 Litigation decided in our favor. Address J. W. STOCKWELL & CO., Portland, Me.

Steel Castings,

From ¼ to 10,000 lbs. weight. An invaluable substitute for expensive forgings, or for malleable iron castings requiring great strength. Send for circular and price list to CHESTER STEEL CASTING COMPANY, Evelina Street, Philadelphia, Pa

$57.60 AGENTS' PROFITS per week. Will prove it or forfeit $500. New articles are just patented. Samples sent free to all. Address
W. H. CHIDESTER, 218 Fulton St., New York.

A PRACTICAL ENGINEER & DRAUGHTSMAN, over 10 years' experience in Designing all kinds of Steam Engines, Boilers, Brewery and general Machinery, in Making Estimates Specifications and Contracts, desires a Situation as Draughtsman Addres
RUDOLF FAHR, 262 Croghan St., Detroit, Michs

COMPRESSED AIR MOTIVE POWER.—For particulars of the most recent practice, send 20 cents for SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 1 and 2, containing 5 engravings of the "Compressed Air" Locomotives now in use in St. Gothard Tunnel Works, with dimensions, etc.

© 1876 SCIENTIFIC AMERICAN, INC.

Rose's Complete Practical Machinist: The most valuable Book on the subject in the English language.

The Complete Practical Machinist:

Embracing Lathe Work, Vise Work, Drills and Drilling, Taps and Dies, Hardening and Tempering, the Making and Use of Tools, etc. etc. By Joshua Rose. Illustrated by 130 Engravings. In one Volume, 12mo., 376 pages. Price $2.50, by mail, free of postage.

CONTENTS.

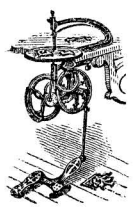
CHAPTER I. LATHE AND MACHINE TOOLS.—Round-Nosed Tools; Square-Nosed Tools: Holding Tools; Side Tools for Iron. Front Tool for Brass Work; Side Tool for Brass Work. II. CUTTING SPEED AND FEED.—Tables of Cutting Speeds and Feeds; Table for Steel; Table for Wrought Iron; Table for Cast Iron: Table for Brass; Table for Copper III. BORING TOOLS FOR LATHE WORK.—Boring Tool for Brass; Boring Tool Holders. IV. SCREW-CUTTING TOOLS.—Hand Chasing; To Make a Chaser; To Calculate the Gear Wheels necessary to cut a Thread in a Lathe. V. GENERAL OBSERVATIONS ON LATHE WORK.—H. S. Manning & Co.'s Lathe Dogs and Drivers; Emery Grinders; H. S Manning & Co.'s Centering Machine; Lathe Work; Emery Cloth and Paper. VI. TURNING ECCENTRICS.—Turning Cranks; To Chuck a Crosshead; Turning Pistons and Rods; Piston Rings; Ball Turning; Cone Plate for Boring in the Lathe; To Turn a Pulley; Turning and Fitting Tapers; Belts; Oiling and Greasing of Belts; Directions for Calculating the Width of Belts required for Transmitting Different Numbers of Horse Power; Directions for Calculating the Number of Horse Power which a Belt will Transmit, its Velocity and the Number of Square Inches in Contact with the Smallest Pulley being Known VIII. HAND TURNING.—Roughing Out; The Graver; The Heel Tool; Brass Work; Scrapers; Lathe Chucks VIII. DRILLING IN THE LATHE.—Half-Round Bits; Cutters; Reamers; Shell Reamers; IX. BORING BARS.—Small Boring Bars. X. LAPS.—Allowance for Shrinkage; Crank Pins; Chucking Brasses; Slotting Machine Tools XI. TWIST DRILLS.—Feeding Drills; Drills and Drilling—Flat Drills; Drilling Hard Metals: Slotting or Keyway Drills; Pin Drills; Countersink Drills. XII. TOOL STEEL.—Forging Tools; Tool Hardening and Tempering: Hardening; To Harden Springs; Case Hardening Wrought Iron; To Case Harden Cast Iron; To Harden Malleable Iron; The Crystallization of Wrought Iron; The Wear of Metal Surfaces; Annealing or Softening; Mixtures of Metals. XIII. TAPS AND DIES.—Adjustable Dies; Dies for Use in Hand Stocks. XIV. VISE WORK—TOOLS.—Calipers; The Square; The Scribing Block; Chipping; Filing; Emery Paper; Tools for Scraping Surfaces; Vise Clamps; Penning; Fitting Brasses to their Boxes; Fitting Link Motions; Fitting Cylinders; Scraped Surfaces; To Make a Surface Plate; To Cut Hard Saw Blades; To Refit Leaky Plugs to their Cocks; Refitting Work by Shrinking it; To Estimate the Weight of a Casting from the Weight of the Pattern; Grades and Speeds for Emery Wheels; Threads of Gas or Steam Pipes; Steam and Water Joints; To Make Spiral Springs; Hardening; Tempering. XV. FITTING CONNECTING RODS.—Drifts; Reverse Keys. XVI. MILLING MACHINES AND MILLING TOOLS.—XVII. TO CALCULATE THE SPEED OF WHEELS, PULLEYS, ETC.—XVIII THE SLIDE VALVE.—Movements of Piston and Crank; Steam Supply; To Measure the Throw of an Eccentric XIX HOW TO SET A SLIDE VALVE.—XX. PUMPS.—Suction Pumps; Force Pumps; Piston Pumps.—INDEX.

☞ The above or any of our books sent by mail, free of postage, at the publication price.

A select list of books on Steam and the Steam Engine, with prices, sent free upon application.

Our new and enlarged Catalogue of Practical and Scientific Books, 96 pages, 8vo, sent free to any one who will furnish his address.

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS AND IMPORTERS,
810 WALNUT STREET, Philadelphia.



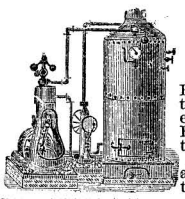
FLEETWOOD SCROLL SAW,
Especially adapted to the
Finest and most Artistic Work,
such as **Inlaying and Sorrento Cutting in** WOOD, SHELL, IVORY **and** METALS.

☞ Every Machine Warranted as represented. Price $10 to $15.

Send Stamp for Descriptive Circular and Illustrated List of Designs for BRACKETS, BOXES, EASELS, FRAMES, &c.

TRUMP BRO'S, M'f'rs,
Wilmington, Del.

SECTIONAL STEAM BOILER PATENTS.—The United States, English, and Canadian Patents on a first class Sectional Safety Boiler for Sale. One of these Boilers is now in daily operation at the Centennial. Address Lock Box 102, New Brunswick, N. J.



YALE IRON WORKS,
New Haven, Conn.,
Builders of the YALE VERTICAL, the *best* and most *Economical*, either for land or marine use; also HORIZONTALS, with or without the *Rider* Cut-off.

SPECIAL TOOLS made to order, all at prices that defy competition. Send for Circular.

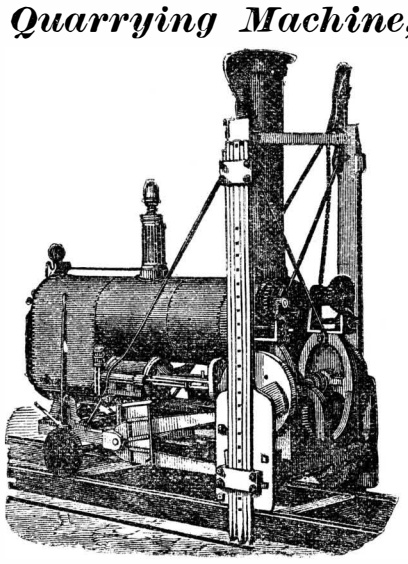
Planing & Matching.

Moulding, Re-sawing, and Tenoning Machines. Scroll Saws and General Wood-Working Machinery.
JOHNB. SCHENCK'S SONS { Matteawan, N. Y.
Send for Catalogue. { 118 Liberty St., N. Y. city.

Wood-Working Machinery,

Such as Woodworth Planing, Tongueing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines, and Wood-Working Machinery generally. Manufactured by
WITHERBY, RUGG & RICHARDSON,
26 Salisbury Street, Worcester, Mass.
(Shop formerly occupied by R. BALL & CO.)

Stone Channeling OR *Quarrying Machine,*



WARDWELL PATENT,
FOR CUTTING STONE INTO VARIOUS SIZES AND DIMENSIONS IN ALL KINDS OF QUARRIES.
STEAM STONE CUTTER CO., RUTLAND, VT.
SOLE PROPRIETORS AND MANUFACTURERS.
☞ **Three Machines at Philadelphia Exhibition, Annexe No. 2, Machinery Hall.**

STEAM PUMPS.

FIRST PRIZES, VIENNA, PARIS, NEW YORK, BALTIMORE, BOSTON.
Send for circular of recent patented improvements.
THE NORWALK IRON WORKS.
South Norwalk, Conn.

FRICTION CLUTCHES AND ELEVATORS.

VOLNEY W. MASON & CO. PROV. R. I.

At Centennial Exhibition, Machinery Hall, D. 9, 66. Also at entrance to Pump Annex.

RACING BOAT STOCK.

SPANISH & WHITE CEDAR.

Extra lengths and quality, from 3-16th thick up, planed and unplaned. Also, full stock of HARD-WOOD LUMBER and VENEERS, MAHOGANY, SATINWOOD ROSEWOOD, WALNUT, &c.

Inclose Stamp for Catalogue and Price-List.

Geo. W. Read & Co.,
186 to 200 Lewis st., ft. 5th & 6th sts., E. R., N. Y

Gardiner's Pat. Centring & Squaring Attachment

R. L. STATE & CO., Springfield, Ohio.

$50.00 SCREW-CUTTING **FOOT LATHES**—Foot Drill Presses. Send for Circular to H. L. SHEPARD, Cincinnati, O.

IRON PLANING MACHINES A SPECIALTY. C WHITCOMB & CO., M'f'rs, Worcester, Mass.

WROUGHT IRON BEAMS & GIRDERS

THE UNION IRON MILLS, Pittsburgh, Pa.—The attention of Engineers and Architects is called to our improved Wrought-Iron Beams and Girders (patented), in which the compound welds between the stem and flanges, which have proved so objectionable in the old mode of manufacturing, are entirely avoided. We are prepared to furnish all sizes at terms as favorable as can be obtained elsewhere. For descriptive lithograph, address Carnegie Brothers & Co., Union Iron Mills, Pittsburgh, Pa.

HARVARD UNIVERSITY DENTAL SCHOOL. The next year of this school begins under the new plan, Sept. 28, 1876, and ends June 27, 1877, with a recess of one week at Christmas and another in February. The teaching is consecutive through a course of two years, the instruction of one year not being repeated in the next; that of the first year being identical with that of the Harvard Medical School and by the same Professors. By this plan, the amount of instruction given is double that of any other strictly dental school, and at slightly increased cost. For information, address THOMAS H. CHANDLER, Dean, 222 Tremont Street, Boston, Mass

---

NOTICE TO MILLWRIGHTS.

Tenders are invited, from responsible parties, for the Millwright work in the "Dunlop Elevator and Mill," on Quay Street, Albany, N. Y. For further information, apply to FRANK CHAMBERLAIN, ESQ.,
551 Broadway, Albany, N. Y.

Lathes, Planers, Shapers, Drills,

Gear & Bolt Cutters, &c. E. GOULD, Newark, N. J.

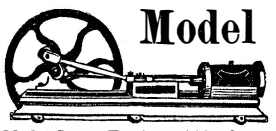
MANUFACTURER OF FIRST CLASS TAPS AND DIES, Pawtucket, R. I.

STEAM ENGINES FOR SALE.

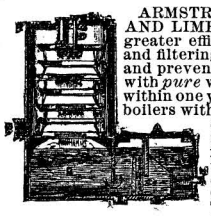
I offer the following very superior Todd & Rafferty Engines for sale at greatly reduced prices: One 18x36, one 14x18 (sawmill), one 12x14, one 11x24, one 10x24, one 9x20, one 7x16, one 5x10 on legs, one 8x12, portable, one 8x16, double hoisting; all first class and entirely new. Also various sizes and kinds of Boilers. I will also furnish specifications and estimates for all kinds of rope and bagging machinery. Send for descriptive circular and price.
Address J. C. TODD.
10 Barclay St., New York, or Paterson, N. J.

ALCOTT LATHES, for Broom, Rake and Hoe Handles S. C. HILLS, 51 Cortlandt St., N. Y

Model Engines.



Complete sets of
Castings
for making small
Model Steam Engines 1½ in. bore, 3 in. stroke, price $4; ditto 2 in. bore, 4 in. stroke, price $10, same style as cut. Eureka Foot Lathes only 15 Dollars. Gear Wheels and Parts of Models. All kinds of Small Tools and Materials. Illustrated Catalogue Free.
GOODNOW & WIGHTMAN, 23 Cornhill, Boston, Mass.



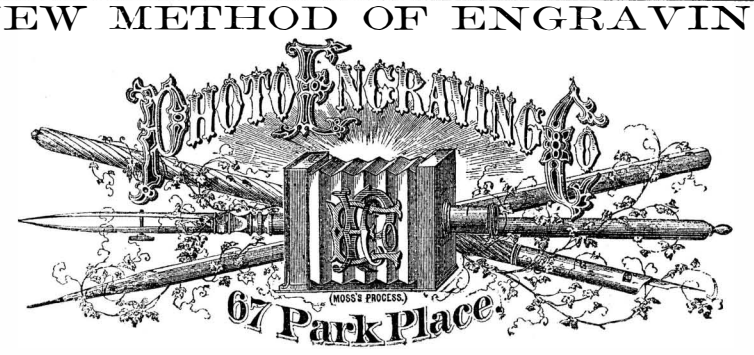
ARMSTRONG'S HEATER, FILTER, AND LIME EXTRACTOR combines the greater efficacy in heating, condensing, and filtering *impure* water. It removes and prevents scales by supplying Boilers with *pure* water. Will save its cost in fuel within one year. No one should use steam boilers without one. Also Manufacturers of the **Perkins Stationary Steam Fire Pump,** reliable for any service, fully guaranteed. For particulars and circulars, address BAUGHMAN, CURTIS & CO., Manufacturers, Toledo, Ohio.

CIVIL and MECHANICAL ENGINEERING at the Rensselaer Polytechnic Institute, Troy, N. Y. Instruction very practical. Advantages unsurpassed in this country. Graduates obtain excellent positions. Re-opens Sept. 15th. For the Annual Register, containing improved Course of Study, and full particulars, address PROF. CHARLES DROWNE, Director.

EAGLE FOOT LATHES,

With Scroll and Circular Saw Attachments, Slide Rest, Tools, &c.; also Small Engine Lathes, Metal Hand Planers, &c. Neatest designs, superior finish. **Low Prices.** Our new Catalogue describes these and every tool necessary for the Amateur or Artizan. Send for it.
WM. L. CHASE & CO.
95 & 97 Liberty St. New York.

NEW METHOD OF ENGRAVING.



L. SMITH HOBART, President.
JOHN C. MOSS, Superintendent.
D. I. CARSON, General Agent.

NEW YORK.

The Photo-Engraving Company, late of 62 Courtlandt St., now at 67 Park Place, beg to call the attention of *Artists, Authors,* MANUFACTURERS, INVENTORS, *Publishers, Printers,* etc., to their method of preparing Relief Plates as a Substitute for Wood Cuts, for Printing Illustrations in Books, Newspapers, Catalogues, Circulars, &c.

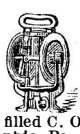
This method, though comparatively new, has passed the stage of Experiment and demonstrated its Success by more than four years' practical test. Its productions have been used in every State and Territory of the Union and in England. These plates are in hard type metal, engraved chiefly by means of photography, have a perfectly smooth printing surface, and are furnished on blocks type high, ready for use on any type-printing press. They will wear as long as any Stereotype plates. Electrotypes and steteotypes may be made from them in the usual way.

"COPY."—Almost all kinds of prints may be transferred or reproduced direct. For original work, pen and ink drawings are necessary. These may be made from photographs, pencil sketches, or from objects themselves. We keep a corps of draughtsmen trained to do this work in first class style. We are also glad to have parties prepare their own drawings, and subjoin a few *Hints to Artists:* The most essential point is to make every line *perfectly black*—not brown, or pale, or bluish—but BLACK. For fine work, make the drawings twice the dimensions of the desired plate, allowing for the reduction by making it proportionately coarser. Draw on a white smooth surface. Good Bristol board is good enough. Make every line as smooth and clean as possible. Carefully observing these requirements, the artist is at liberty to follow his own individual style, and every line will be faithfully reproduced as it is drawn.

We have no agencies and employ no agents. We cannot furnish any price list. We will promptly give estimates; but the copy to be used must in all cases be submitted, with full specifications.

The SCIENTIFIC AMERICAN uses our plates. Send stamp for Summer Edition of our Illustrated Quarterly Circular. Please say where you saw this.

PHOTO-ENGRAVING CO., 67 Park Place, New York.



CENTENNIAL IMPROVED AIR PUMP.
$16 only for a double-acting fly-wheel pump, to compress air to 20 lb. Same style for higher pressure (or condensing) $23 to $28. Vacuum pump, $18. Glass and galv. iron receivers, pump plates, gauges, etc., on hand. Orders promptly filled C. O. D. H. WEINDEL, 460 Dillwyn St., Philadelphia, Pa.

THE CENTENNIAL INTERNATIONAL EXHIBITION OF 1876.—The full History and Progress of the Exhibition, maps of the grounds, engravings of the buildings, news and accounts of all the most notable objects, are given weekly in the SCIENTIFIC AMERICAN SUPPLEMENT. Terms, $5 for the year; single copies 10 cts. To be had at this office, and of all news agents. All the back numbers, from the commencement on January 1, 1876, can be had. Those who desire to possess a complete and splendid Illustrated Record of the Centennial Exposition, should have the SCIENTIFIC AMERICAN SUPPLEMENT.

FILTERED, LUBRICATING OIL.

PURE, NATURAL, AND UNADULTERATED
SEND $8.00 FOR BBL OF 47 GALS.
IAS. M. BINGHAM.
OIL CITY, PA.

A NEW DEPARTURE Traveling & Local Salesmen wanted in every city and town in the U. S. AND CANADA to introduce our Old and Staple MANUFACTURES. $75 PER MONTH. Hotel and Traveling Expenses paid. Apply by letter or in person to S. A. GRANT & CO., 2, 4, 6 & 8 Home St., CINCINNATI, O.

PUNCHING AND DROP PRESSES. For the **Best** and **Cheapest,** address THE STILES & PARKER PRESS CO., MIDDLETOWN, CONN.

SCREW PROPELLERS, THEIR SHAFTS AND FITTINGS. By Hamilton W. Pendred, M. E. An able treatise, showing the present practice, its advantages and defects. With 25 figures. Price 10 cents. Continued in No. 4 of SCIENTIFIC AMERICAN SUPPLEMENT. To be had at this office, and of all news agents.

CENTENNIAL MILLS.

Harrison's Standard Flouring and Grinding Mills

Excel all others in Machinery Hall in the quantity and quality of flour and meal produced, and are ahead of the age. **Prices 50 per cent below any others in the market.**

Millers and others are invited to examine their peculiarities. Call on or address
EDWARD HARRISON,
Post 59, Sec. E, No. 8, Machinery Hall, Philadelphia, Pa.

$12 a day at home. Agents wanted. Outfit and terms free. TRUE & Co., Augusta, Maine.

SPARE THE CROTON & SAVE THE COST.

Driven or Tube Wells

furnished to large consumers of Croton and Ridgewood Water. WM. D. ANDREWS & BRO., 414 Water St., N. Y. who control the patent for Green's American Driven Well.

$5 to $20 per day at home. Samples worth $1 free. STINSON & Co., Portland, Me.

PATENT COLD ROLLED SHAFTING

The fact that this shafting has 75 per cent greater strength, a finer finish, and is truer to gage, than any other in use, renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS' PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS,
Try Street, 2nd and 3rd Avenues, Pittsburgh, Pa.
190 S. Canal Street, Chicago, Ill.
☞ Stocks of this shafting in store and for sale by
FULLER, DANA, & FITZ, Boston, Mass.
GEO. PLACE & CO., 121 Chambers St., N. Y.
PIERCE & WHALING Milwaukee Wis.

REVERSIBLE HOISTING ENGINE

FOR ALL PURPOSES.
☞ Cheap, simple, durable, and effective.
LIDGERWOOD M'F'G CO., 165 Pearl St. N. Y

WANTED Men to travel and sell goods to dealers. No peddling. $80 a month, hotel and traveling expenses paid MONITOR MANUFACTURING CO., Cincinnati, Ohio.

NORWICH University Scientific and Military School, Northfield, Vt. Address Prof. CHARLES DOLE.

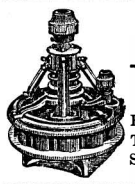
MANUFACTURERS AND PATENTEES having useful articles, suitable for the Hardware Trade, and desiring aid to manufacture and introduce the same, address P. P. PRATT, care PRATT & Co., Buffalo, N. Y. Small samples may be sent, same to be returned if desired.

OTIS' SAFETY HOISTING Machinery.

OTIS, BROS. & CO.
No. **348** BROADWAY, NEW YORK.

JUST OUT. THE ALERT BURGLAR ALARM. The cheapest and most effective ever invented. A big thing for wide-awake agents. Send stamp for terms, or 50c. for one as sample. E. DAUPHINOT & CO., 33 Park Row, N. Y.

MACHINERY OF IMPROVED STYLES FOR making SHINGLES, HEADING, and STAVES; also GUAGE LATHES for TURNING HANDLES. Sole makers of Laws Pat. Shingle and Heading Sawing Machine. Address TREVOR & CO., Lockport, N. Y.



N. F. BURNHAM'S 1874 TURBINE Water Wheel

Has DISPLACED hundreds of other Turbines, but HAS NEVER BEEN ITSELF DISPLACED. Pamphlet Free.
N. F. Burnham, York, Pa.

BLOSSOM ROCK, HARBOR OF SAN FRANCISCO. Full Account of its Removal, Method and Cost. By Col. R. S. Williamson. With 25 illustrations, diagrams, &c. Presenting valuable information for engineers. Price 10 cents. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 24. To be had at this Office and of all News Dealers.

THE BEST

GOLD PENS

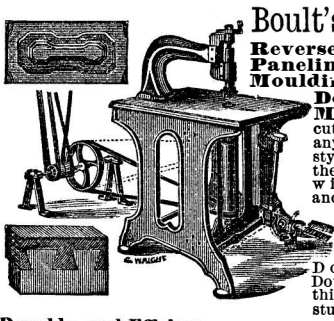
Are manufactured by JOHN HOLLAND, No. 19 West Fourth St., Cincinnati. By a patent process he alloys pure gold so as to make it as elastic as Damascus Steel. **Prices as low as the old style.** Send for illustrated price list

New York Agency 100 Nassau Street.

Pond's Tools.

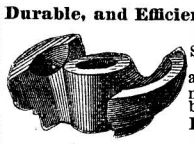
ENGINE LATHES, PLANERS, DRILLS, &c.
Send for Catalogue. DAVID W. POND, Successor to LUCIUS W. POND, **Worcester, Mass.**

S. GUITERMAN, Export and Commission Merchant, 2 Fountain Court, Aldermanbury, London. New York Office, Guiterman Bros., 454 Broadway. Best of attention to introduce Merchandise, Patents, etc., in any part of Europe.



Boult's Patent

Reverse Motion Paneling, Variety Moulding and Dovetailing Machine, cuts Panels of any design or style of mould in the solid wood with neatness and dispatch. Is a first class Shaper, Edge and Scroll Moulder Does general Dovetailing with thick or thin stuffs. **Simple, Durable, and Efficient.**



☞ Send for Pamphlet and Sample of work.

Improved Solid Steel Cutters for all kinds of Variety Moulders made to order, and warranted by the
B. C. MACHINERY CO.,
Battle Creek, Mich.

P. BLAISDELL & CO.,

Worcester, Mass.,
Manufacturers of the Blaisdell Patent Upright Drill and other first-class Machinist's Tools.

Stubs' Files, Tools & Steel.

Machinists' Fine Tools, Jewelers' and Engravers' Supplies, Lathes, Chucks, Vises, Taps and Dies, Reamers, Morse Drills, Files, and small Tools of all kinds, for amateurs or practical workmen. Huberts' French Emery Paper, Grobet's Swiss Files, Bracket Saws, etc. Agent for the Almond Drill Chuck. Best and cheapest in the market. Price $5.00.
J. M. MONTGOMERY,
105 Fulton St., New York

$77 A WEEK to Agents, Old & Young, Male & Female, in their locality. Terms & OUTFIT FREE. Address P. O. VICKERY & CO., Augusta, Me.

SHAFTS, PULLEYS, HANGERS COUPLINGS ETC.

In Stock, and for Sale by
WILLIAM SELLERS & CO.,
Philadelphia, and 79 Liberty St., New York.
Price lists and pamphlets on application.

BLAKE'S PATENT
Stone and Ore Breaker

Crushes all hard and Brittle Substances to **any required size.** Also, any kind of STONE for ROADS and for CONCRETE, &c.
Address BLAKE CRUSHER CO.,
New Haven, Conn.

The HOADLEY PORTABLE STEAM ENGINE.
WITH AUTOMATICAL CUT-OFF REGULATOR AND BALANCED VALVE.
THE BEST & MOST ECONOMICAL ENGINE MADE
SEND FOR CIRCULAR.
The J. C. HOADLEY CO. LAWRENCE, MASS.
STATE WHERE YOU SAW THIS.

VELOCIPEDE CARRIAGES, OF LIGHT CONstruction, fast speed. Worked by hand cranks, also by foot treadles. Illustrated in SCIENTIFIC AMERICAN SUPPLEMENT No. 8. To be had at this office and of all news agents. Price 10 cents.

$250 A MONTH—Agents wanted everywhere. Business honorable and first class. Particulars sent free. Address J. WORTH & CO., St. Louis, Mo.

© 1876 SCIENTIFIC AMERICAN, INC.

Advertisements.

Back Page - - - - - - - - - $1.00 a line.
Inside Page - - - - - - - - 75 cents a line.
Engravings may head advertisements at the same rate ver line by measurement. as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

ROCK-DRILLING MACHINES
AND
AIR COMPRESSORS,
Manufactured by
BURLEIGH ROCK DRILL CO.,
Send for Pamphlet. **Fitchburg, Mass.**

R. HOE & CO.,
Grand, Broome, Sheriff, Columbia, and Gold Streets, New York.
CAST STEEL SAWS
OF EVERY DESCRIPTION.
Send for Reduced Price List a d Description of their
NEW PATENT
Chisel Tooth Circular Saws,
which cut faster, more easily and economically than any other saw in the world. **R. HOE & Co.,**
504 Grand St.. cor. Sheriff St., N.Y.

MACHINERY
OF EVERY DESCRIPTION,
COLD ROLLED SHAFTING, HANGERS, PULLEYS, COUPLINGS. BELTING, TANITE EMERY WHEELS AND GRINDERS, IN STOCK.
GEORGE PLACE,
121 Chambers & 103 Reade Sts., New York City.

WIRE ROPE
Address JOHN A. ROEBLING'S SONS, Manufacturers, Trenton, N. J., or 117 Liberty St., New York. Wheels and Rope for conveying power long distances. Send for Circular.

FOR SALE—One second hand No. X Cotton, Hide, Wool, Hair, and Hay Press, made by Dederick & Co., Albany, N. Y. Was used less than one week, and in perfect order. Address BERRY BRO'S, Detroit, Mich.

FOR SALE—One second hand Bone Crusher and Lightning Mill. for grinding Bones, Ores, &c. Will sell very cheap. Address
BERRY BRO'S, Detroit, Mich.

FOR SALE—A Valuable Patent, in whole or part, for renovating Black Crape Laces, &c., which makes them superior to new. Address A. J. SHRIVER, No. 157 West Fayette St., Baltimore, Md.

[ESTABLISHED 1846.]

Munn & Co.'s Patent Offices.

The Oldest Agency for Soliciting Patents in the United States.

THIRTY YEARS' EXPERIENCE.

MORE PATENTS have been secured through this gency, at home and abroad, than through any other in he world.

They employ as their assistants a corps of the most experienced men as examiners, specification writers, and draftsmen that can be found, many of whom have been selected from the ranks of the Patent Office.

SIXTY THOUSAND inventors have availed themselves of Munn & Co.'s services in examining their inventions and procuring their patents.

MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine inventions, confer with inventors, prepare drawings, specifications, and assignments, attend to filing applications n the Patent Office, paying the government fees, and watch each case step by step while pending before the examiner. This is done through their branch office, corner F and 7th streets, Washington. They also prepare and file caveats, procure design patents, trademarks, and reissues, attend to rejected cases (prepared by the inventor r other attorneys), procure copyrights, attend to interferences, give written opinions on matters of infringement, furnish copies of patents, and, in fact, attend to every branch of patent business both in this and in foreign countries.

A special notice is made in the SCIENTIFIC AMERICAN of all inventions patented through this agency, with the name and residence of the patentee. Patents are often sold, in part or whole, to persons attracted to the invention by such notice.

Patents obtained in Canada, England, France, Belgium, Germany, Russia, Prussia, Spain, Portugal, the British Colonies, and all other countries where patents are granted, at prices greatly reduced from former rates. Send for pamphlet pertaining specially to foreign patents, which states the cost, time granted, and the requirements or each country.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet containing the laws and full directions for obtaining United States patents sent free. A handsomely bound Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful handbook of reference for everybody. Price 25 cents, mailed free.

Address
MUNN & CO.,
Publishers SC ENTIFIC AMERICAN,
37 Park Row, N. Y.

BRANCH OFFICE—Corner **F and 7th Streets, Washington, D. C.**

PRICE ONLY $12.

NEW IMPROVED AIR RIFLE,
For Target Practice and Shooting Small Game.
☞ **THE BEST AIR RIFLE MADE.** ☜
Sent upon receipt of price, or C. O. D. **Send for Circular.**
Address H. M. QUACKENBUSH, M'F'R, Herkimer, N. Y.
Also Manufacturer of Superior Patented Steel Air Gun and Pistol Darts of all si es, Slugs, &c.

SCHLENKER'S
Stationary-Die and Revolving-Die
Bolt Cutters.
THE BEST AND CHEAPEST MADE.
HOWARD IRON WORKS,
Buffalo, N. Y.
☞ Send for Catalogue. ☜

Diamond Solid Emery Wheels.
PRICES—6x¾, $1.25; 8x1, $2.25; 12x1½, $5.50; 16x2, $12.50; 18x2, $16.00; 20x2, $19.50; 24x3, $42. All other sizes at proportionate prices. Fast cutting, free from glazing, they are the best Solid Emery Wheels. Give diam. of holes in your order for wheels. Emery Grinders unequalled by any in the world. Address AMERICAN TWIST DRILL CO., Woonsocket, R. I.

To Engineers—A Valuable Investment.
For Sale and to Rent—The Grand Rapids Iron Works, Grand Rapids, Mich. (established 1842); with Water and Steam Power, Machinery and Tools of the best description, Valuable Stock of Patterns, Boiler Shop, Machine Shop, Blacksmith's Shop, Foundry, and other Buildings. The present Proprietors would be willing to retain an Interest with a Skillful and Energetic Principal.
BUTTERWORTH & LOWE.

BOILERS—If you wish to save fuel, get one of our Patent Tubular Boilers. We have seven different styles.
J. HEATHCOTE & CO., Boiler Makers, Williamsport, Pa.

HOW TO MAKE SPIRAL SPRINGS. By Joshua Rose. With three engravings of the tools, which are easily made, and complete practical directions for working, including Hardening and Tempering. Price 10 cents. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 20. To be had at this office and at all News Stores throughout the country.

NON-COMBUSTIBLE STEAM BOILER & PIPE
COVERING
WITH "AIR SPACE" IMPROVEMENT.
Saves 10 to 20 per cent. CHALMERS SPENCE CO.,
Foot E. 9th St., N. Y.; 1202 N. 2nd St., St. Louis, Mo.

WHIPPLE'S
Patent Door Knob.
Awarded a Bronze Medal at the American Institute Fair for 1874. The Judges say: "We consider this method of fastening DOOR KNOBS a great improvement over anything yet invented for the purpose, as it obviates the use of side screws and washers, and can be regulated to suit any thickness of Doors." Send for Circular.
THE PARKER & WHIPPLE COMPANY,
West Meriden, Conn.. or 97 Chambers St., N. Y.

TO INVENTORS AND MANUFACTURERS
The 45th Exhibition of the American Institute will open September 6th; Machinery will be received after August 14th, other goods after August 28th. Increased awards and a Special Gold Medal for this year. For particulars, blanks, etc., address "General Superintendent American Institute, New York."

PERFECT
NEWSPAPER FILE.
—:o:—
The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and CIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of $1 50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.
Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN

SOLID WEALTH!
$600,000 IN GIFTS!
☞ *Grandest Scheme ever Presented to the Public!* ☜
A FORTUNE FOR ONLY $12.
THE KENTUCKY
CASH DISTRIBUTION COMPANY
authorized by a special act of the Kentucky Legislature, for the benefit of the **Public Schools of Frankfort,** will have the First of their series of Grand Drawings at **MAJOR HALL,** in the **CITY OF FRANKFORT, KY.,**
THURSDAY, AUGUST 31, 1876,
on which occasion they will distribute to the ticket holders the immense sum of
$600,000!
Thos. P. Porter, Ex-Gov. Ky., Gen'l Manager
POSITIVELY NO POSTPONEMENT!

One Grand Cash Gift		**$100,000**
One Grand Cash Gift		**50,000**
One Grand Cash Gift		**25,000**
One Grand Cash Gift		**20,000**
One Grand Cash Gift		**10,000**
One Grand Cash Gift		**5,000**
50 Cash Gifts of	**$1,000 each**	**50,000**
100 Cash Gifts of	**500 each**	**50,000**
100 Cash Gifts of	**400 each**	**40,000**
100 Cash Gifts of	**300 each**	**30,000**
200 Cash Gifts of	**200 each**	**40,000**
600 Cash Gifts of	**100 each**	**60,000**
10,000 Cash Gifts of	**12 each**	**120,000**
Total, 11,156 Gifts, All Cash		**600,000**

PRICE OF TICKETS:
Whole tickets, $12; Halves, $6; Quarters, $3; 9 Tickets, $100, 27¾ Tickets, $300; 46¼ Tickets, $500; 95¾ Tickets, $1,000. 100,000 Tickets at $12 each.
Hon. E. H. Taylor, Mayor of Frankfort, the entire board of City Councilmen, Hon. Alvin Duvall, late Chief Justice of Kentucky, and other distinguished citizens, together with such disinterested persons as the ticket holders present may designate, will superintend the drawing.
Remittances can be made by Express, Draft, Post-office Money order or Registered Letter, made payable to *KENTUCKY CASH DISTRIBUTION COMPANY.*
All communications, orders for Tickets, and applications for Agencies should be addressed to
HON. THOS. P. PORTER,
General Manager, Frankfort, Ky.
or **G. W. BARROW & CO.,**
General Eastern Agents, 710 Broadway, N. Y

The Scientific American
REFERENCE BOOK.
A Bound Book of 144 Pages, for 25c.

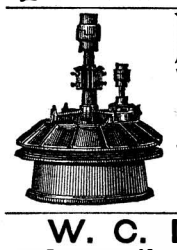
On receipt of 25 cents, we send by mail, post paid, a copy of a handsome little bound volume entitled the SCIENTIFIC AMERICAN REFERENCE BOOK, containing 144 pages illustrated with engravings, and forming one of the cheapest and most valuable books of condensed reference ever printed. Among its contents are:

1. **The Census of the United States,** by States, Territories, and Counties, *in full,* showing also the area of the several States.
2. **Table of Occupations.**—Showing the principal occupations of the people of the United States, and the number of persons engaged in each occupation. Compiled from the last Census.
   Table of Cities having over 10,000 inhabitants—Compiled from the last Census.
3. **The Patent Laws** of the United States in full. With Directions How to Obtain Patents, Official Rules, Costs, etc.; Forms for Applications for Patents and Caveats; Forms for Assignments, in whole and part; Licences; State, Town, County, and Shop Rights; Directions How to Introduce and Sell Inventions; General Principles applicable to Infringements; Synopsis of the Patent Laws of Foreign Countries, Costs, Procedure, Rights of Employers and Employees in respect to Inventions; State Laws concerning Patents.
4. **United States Trade Mark Registration,** showing the Trade Mark Law in full, with Directions for Registering Trade Marks, Costs, etc.
5. **United States Copyright Law for Labels,** in full. With Directions, Expenses, etc.
6. **The Principal Mechanical Movements.** Described and illustrated by 150 small diagrams, of great value to Inventors and Designers of Mechanism.
7. **Geometry,** as Applied to Practical Purposes. With illustrations.
8. **The Modern Steam Engine.**—With engraving, showing all the parts, names, etc., and a brief history of the Invention and Progress of Steam Power.
9. **Horse Power.**—Simple and plain rules for Calculating the Horse Power of Steam Engines and Streams of Water.
10. **Knots.**—Presenting engravings of 48 different kinds of Rope Knots, with explanations as to tying.
11. **Tables of Weights and Measures.**—Troy Weight; Apothecaries' Weight; Avoirdupois, or Commercial Weight; French Weights; United States Standard; Dry Measure; Land Measure; Cubic Measure; Liquid Measure; French Square Measure; French Cubic, or Solid Measure; Measuring Land by Weight, with engraving of a section of the English and a section of the French rule, of equal length
12. **Valuable Tables:**
    (1) Table of the Velocity and Force of the Wind.
    (2) Table of the Specific Gravity and Weight per Cubic ootand Cubic inch, of the principal substances used in the Arts.
    (3) Table of the Heat-Conducting Power of various Metals and other Solids and Liquids.
    (4) Table of the Mineral Constituents absorbed or removed from the Soil, per acre, by different crops.
    (5) Table of Steam Pressures and Temperatures.
    (6) Table of the Effects of Heat upon various bodies, melting points, etc.
13. **Miscellaneous Information.**—Force of Expansion by Heat; small Steamboats, proper dimensions of engines, boilers, propellers. boats; Incubation, Temperature of; To Make Tracing Paper; Constituents of various Substances; Friction, how produced, and Rules for Calculation; Specific Heat Explained; Specific Gravity of Liquids, Solids, Air, and Gases; Gunpowder—Pressure, Heat, and Horse Power of; Copying Ink, to Make; Heat, its mechanical equivalent explained; Molecules of Matter, size and motion explained; Lightning and Lightning Rods—valuable information; Value of Drainage Explained; Amount of Power at present Yielded from Coal by best Engines; Sound—its velocity and action; Liquid Glues, Recipes; Value of Brains; Properties of Charcoal; Hight of Waves; Speed of Electric Spark, etc.; Valuable Recipes.

The SCIENTIFIC AMERICAN REFERENCE BOOK. Price only 25 cents, may be had of News Agents in all parts of the country, and of the undersigned. Sent by mail on receipt of the price.

MUNN & CO., Publishers,
Sc entific American Office,
37 Park Row, New York.

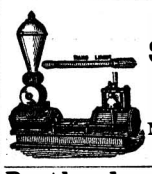
ROGERS' TANNATE OF SODA BOILER SCALE PREVENTIVE.
JOS. G. ROGERS & CO., Madison, Ind.
☞ Send for book on Boiler Incrustation.



HOUSTON TURBINE WATERWHEEL
IMPORTANT IMPROVEMENTS!
SEND FOR NEW CIRCULAR.
MERRILL & HOUSTON IRON WORKS.
BELOIT, WISCONSIN.

W. C. DUYCKINCK,
IMPORTER, MANUFACTURER, AND DEALER IN
Railway, Machinists', and Engineers' Supplies.
50 and 52 JOHN STREET,
P. O. Box 4101. NEW YORK.

MILL STONE DIAMOND DRESSING MACHINES. Simple, effective, and durable. Also, diamond-pointed tools for trueing Emery Wheels, Grindstones, Chilled Iron, and Paper Calender Rolls, and other mechanical purposes. Also, Diamond Tools, Saws, and Drills made to order. J. DICKINSON, 64 Nassau St., N.Y.



Niagara Steam Pump Works
ESTABLISHED 1826.
CHARLES B. HARDICK,
No. 23 Adams Street.
BROOKLYN, N. Y.

Portland and Keene's Cement.
From the best London Manufacturers. For sale by JAMES BRAND, 85 Beekman St., New York.
A Practical Treatise on Cement furnished for 25 cents.

Todd & Rafferty Machine Co.
MANUFACTURERS OF
The celebrated Greene Variable Cut-Off Engine, Lowe's Patent Tubular and Flue Boilers, Plain Slide Valve Stationary, Hoisting, and Portable Engines. Boilers of all kinds. Steam Pumps, Mill Gearing, Shafting, &c., Silk, Tow Oakum, Bagging, Rope, Flax, and Hemp Machinery. Agents for the New Haven Manufacturing Co.'s Machinist's Tools, for Judson's Governors and Stop Valves, Sturtevant Blowers, and Differential Pulley-Blocks. WAREROOMS, 88 LIBERTY STREET, NEW YORK. WORKS, PATERSON NEW JERSEY.

The Tanite Co.,
STROUDSBURG, PA.
EMERY WHEELS & GRINDERS
GEO. PLACE, Gen'l. Agent for N. Y. city and State.

Machinists' Tools.
NEW and IMPROVED PATTERNS.
Send for new illustrated catalogue.
Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO.
New Haven, Conn.

M. SELIG JUNIOR, & CO.,
Importers of American Machinery, Tools, Agricultura Implements, Wholesale and Export Hardware and Machinery Merchants. Est'd 1866.
LONDON, ENGLAND, and BERLIN, GERMANY.

PORTLAND CEMENT
ROMAN & KEENE'S. For Walks, Cisterns. Foundations, Stables, Cellars, Bridges, Reservoirs, Breweries, etc.
Remit 10 cents for Practical Treatise on Cements.
S. L. MERCHANT & CO., 76 South St., New York.

PREPARATORY SCIENTIFIC SCHOOL,
Warren Academy, Woburn, Mass. For circulars, address L. S. BURBANK, PRINCIPAL.

BOGARDUS' PATENT UNIVERSAL ECCENTRIC MILLS—For grinding Bones, Ores, Sand, Old Crucibles, Fire Clay, Guanos, Oil Cake, Feed, Corn, Corn and Cob, Tobacco, Snuff, Sugar, Salts, Roots, Spices, Coffee, Cocoanut, Flaxseed, Asbestos, Mica, etc., and whatever cannot be ground by other mills. Also for Paints, Printers' Inks, Paste Blacking, etc. JOHN W. THOMSON, successor to JAMES BOGARDUS corner of White and Elm Sts.. New York

DAMPER REGULATORS **BEST** AND LEVER GAGE COCKS.
MURRILL & KEIZER, 44 Holliday St., Balt.

HARTFORD STEAM BOILER
Inspection & Insurance COMPANY.
W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.

NOYE'S
Mill Furnishing Works
are the largest in the United States. They make Burr Millstones, Portable Mills, Smut Machines Packers, Mill Picks, Water Wheels, Pulleys and Gearing, specially adapted to flour mills. Send for Catalogue.
J. T. NOYE & SON, Buffalo, N. Y.

OF THE
SCIENTIFIC AMERICAN,
FOR 1876,
THE MOST POPULAR SCIENTIFIC PAPER IN THE WORLD.

THIRTY-FIRST YEAR.

VOLUME XXXV.—NEW SERIES.

The publishers of the SCIENTIFIC AMERICAN beg to announce that on the first day of July, 1876, a new volume commenced. It will continue to be the aim of the publishers to render the contents of the new volume more attractive and useful than any of its predecessors.

To the Mechanic and Manufacturer.

No person engaged in any of the mechanical pursuits should think of doing without the SCIENTIFIC AMERICAN. Every number contains from six to ten engravings of new machines and inventions which cannot be found in any other publication.

The SCIENTIFIC AMERICAN is devoted to the interests of Popular Science, the Mechanic Arts, Manufactures, Inventions, Agriculture, Commerce and the industrial pursuits generally; and it is valuable and instructive not only in the Workshop and Manufactory, but also in the Household, the Library, and the Reading Room. Each volume contains hundreds of Notes, Receipts, and Suggestions and Advice, by Practical Writers, for Working Men and Employers, in all the various arts.

TERMS OF SUBSCRIPTION — POSTAGE PAID BY US.

One copy Scientific American, one year	$3 20
One copy Scientific American, six months.	1.60
One copy Scientific American, three months	1.00
One copy Scientific American and one copy Scientific American Supplement, both for one year, post-paid	7.00

The Scientific American Supplement.

A weekly paper, uniform in size with the SCIENTIFIC AMERICAN, but a distinct publication. It contains working drawings of engineering works, and elaborate treatises on every branch of Science and Mechanics, by eminent writers, at home and abroad. An illustrated cover protects the handsomely printed sheets. Price, $5.00 per annum Single copies 10 cents.

Remit by postal order, draft, or express.

Address all letters and make all Post Office orders and drafts payable to

MUNN & CO
37 PARK ROW, NEW YORK.

The "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK Tenth and Lombard-sts., Philadelphia, and 59 Gold st., New-York.

© 1876 SCIENTIFIC AMERICAN, INC.